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THE  
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OF THE  
ROYAL AGRICULTURAL SOCIETY  
OF ENGLAND.

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*Third Series,*  
VOLUME THE ELEVENTH.

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(BEING THE SIXTH VOLUME ISSUED SINCE THE FIRST PUBLICATION  
OF THE JOURNAL IN 1839.)

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PRACTICE WITH SCIENCE

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*Errata in Part III. of Journal.*

Page 466. Omit last phrase of paragraph 1.

Transpose numbers in paragraph 5 (see Table I. on p. 469).

Page 470. Table III. The strippings of cows 4 and 5 in the afternoon of June 17, and on June 18 and 19 were transposed in compiling the Table, owing to these two cows having been shifted in their stalls. The Table should be amended as follows :—

—		Cow No. 4	Cow No. 5	Cow No. 8	<sup>1</sup> Note.—This large amount of strippings is accounted for by the fact that on the occasion in question the vacuum tube between Cow No. 5 (which became restive), and another Cow got pulled off during the milking, and the teat cups dropped off both cows. The teat cups were replaced on one of the animals; but owing to Cow No. 5 being "upset by the hissing sound of the escaping vacuum, and the cups dropping off about her feet," the Exhibitor (Mr. W. Murchland) did not think it advisable to try her further at that time.
		1b.	1b.	1b.	
June 15	strippings	2½	6	5	
"	16 A.M.	4½	8½	—	
"	16 P.M.	1	2½	2	
"	17 A.M.	3½	3½	2½	
"	17 P.M.	2½	1½	2½	
"	18 A.M.	4	2½	1½	
"	18 P.M.	2½	1	2	
"	19 A.M.	2	1½	2	
"	19 P.M.	1½	1	2	
Total strippings of each cow		23½	28½	12½	
Mean strippings of each cow		2.6	3.2	1.6	

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1847.

1848.

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11/10/19

# JOURNAL OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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PHILIP PUSEY

(JUNE 25, 1799–JULY 9, 1855).

THE name of the first Chairman of the Journal Committee of the Royal Agricultural Society, and the first Editor of this Journal, which is now entering upon its sixty-first annual volume, may possibly be somewhat unfamiliar to latter-day readers. But in his time Philip Pusey was a great agricultural name to conjure with, and it is hardly too much to say that this Society owes more to him than to any other man for his fostering guidance of its early footsteps.

When England began to emerge, about the beginning of Her present Majesty's reign, from the acute agricultural distress into which it had been plunged after the Napoleonic wars, men began to talk about the advantages which might be gained by what Earl Spencer called at the Smithfield Club dinner of 1837 a "national society for agricultural purposes exclusively."<sup>1</sup> Amongst the men of mark to whom this project commended itself was Philip Pusey, then a busy and ardent Member of Parliament, known to and appreciated by the leaders alike of politics, fashion, and literature.

The particular cause of his identifying himself so closely with the national agricultural society that was being projected will probably now never be known; but he was "in the movement," in the prime of life, some of his best friends were on the list of promoters; and so he took the step which, while it brought him renown in his own days, probably shortened his active and useful life.

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<sup>1</sup> See Journal R.A.S.E. 3rd series, vol. i. (1890), p. 2.  
VOL. XI. T. 8.—41

Pusey was present at the inaugural meeting of the English Agricultural Society, held at Freemason's Tavern on May 9, 1838; <sup>1</sup> was elected a member of the original Committee; took a very active share in the preliminaries for the first meeting of the Society at Oxford, where he had spent his undergraduate days; discussed with John Murray the Second the scheme for a journal on the lines of the "Quarterly Review;" and soon proved himself one of the chief pillars and supports of the new and promising Society. He was eminently adapted for the position which he speedily achieved in the counsels of Hanover Square. Hard working, resourceful, at once a profound scholar and a skilled farmer, he carried out the Society's motto, "Practice with Science," with unexampled devotion and ability for the first seventeen years of the Society's existence; but when he passed into the shadow, his splendid efforts were not wholly realised at the time, and to-day he is almost forgotten. It has been judged fitting, therefore, that before the nineteenth century, for whose agriculture he did so much, has come to an end some sketch of his life and work should be given in the Journal to which he devoted so many patient years of loving voluntary labour.

Philip Pusey was born at Pusey, Berks, on June 25, 1799, and was the eldest son of the Hon. Philip Pusey of Pusey, by his wife, Lady Lucy Sherard, daughter of Robert, fourth Earl of Harborough. His father was a Bouverie, the youngest son of Jacob, first Viscount Folkestone, but had assumed the name of Pusey on April 3, 1784, as a condition of succession to the Pusey estates. The original Pusey family was a very old one, dating back certainly to the thirteenth century, and as it possessed an ancient tenure horn (still existing), with the legend "Kyng Knowde [Canute] geve Wylyyam Pewse Thys horne to holde by thy lande," <sup>2</sup> it claimed an even greater antiquity. But the last of the family in the direct line died childless in 1710, and the last female descendant (Miss Jane Allen Pusey) died in 1789, when the property came by the bequest of herself and her sister Elizabeth into the hands of the Hon. Philip Bouverie. <sup>3</sup>

The Hon. Philip Bouverie or Pusey entered into possession of the Pusey estates in 1789, being then forty-one years old and a bachelor. He was a formal, precise, and punctilious

<sup>1</sup> See Journal R.A.S.E., 3rd series, vol. i. (1890), pp. 6-10.

<sup>2</sup> *Archæologia*, vol. iii. 1786.

<sup>3</sup> The whole story of the Puseys and Bouveries is told very completely and accurately by Dr. Liddon in the Appendix to vol. i. of his *Life of Dr. E. B. Pusey* (1893).

man, highly intellectual, and very benevolent and even lavish in his charities (his sons described him on a memorial window as "Philip Pusey, Pious and Bounteous"). After nine years of occupancy of Pusey, he married in 1798 Lady Lucy Sherard, widow of Sir Thomas Cave, Bart., who was twenty-four years his junior. A son, Philip, the subject of this memoir, was born on June 25, 1799, and a second son, Edward Bouverie, afterwards the famous theologian, on August 22, 1800. Subsequently five daughters in succession, and then two sons were born; but as the two elder brothers were divided by an interval of ten years from the two younger, "they thus formed a natural pair, both at home and at school, and were regarded by their parents and by the younger children as a sort of duumvirate, occupying a distinct rank in the family."<sup>1</sup>

In 1807, when Philip was eight years old, the brothers were sent to a preparatory school at Mitcham, kept by the Rev. Richard Roberts, where they had as schoolmates, amongst other men who afterwards became distinguished, Lord Derby and his brother, and Lord Carlisle. Mr. Roberts was a pedagogue of the old type, and a fine classical scholar. His teaching was thorough, and under him both boys laid the foundations of the real scholarship for which each afterwards became famous. From Mitcham they went to Eton, where on January 16, 1812, they were entered in the house of the Rev. Thos. Carter. Subsequently Philip went to Christ Church, where, as at Eton, his greatest friend was Lord Porchester, afterwards the third Earl of Carnarvon. On a visit to Highclere, Pusey fell in love with his friend's sister, Lady Emily Herbert, to whom he became engaged in 1818. Mr. Pusey senior (an inflexible Tory in politics) did not approve of the match, on the ground that Lord Carnarvon was a Whig, who made speeches on behalf of Queen Caroline; but also, it must be said, on the more valid ground of the known delicacy of the lady's family. Presumably on account of his father's objection to his marrying, Pusey (who was, amongst other accomplishments, a good linguist) set off with his future brother-in-law, Lord Porchester, on a foreign tour; and whilst in Spain they had an extremely narrow escape from death. In the course of their wanderings the adventurous travellers fell near Montserrat, Catalonia, into the hands of the insurgent Guerillas, and were on the point of being shot as Constitutionalists (*i.e.* of the army of the Cortes), being only saved by the providential arrival of their carriage. A graphic account of this adventure, which happened in 1822, was after-

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<sup>1</sup> Liddon, vol. i. p. 2.

wards published by Lord Carnarvon,<sup>1</sup> as a note to his book on "Portugal and Galicia," issued in 1836, and in its day a very popular work.

Pusey, his mind expanded and his interests enlarged by foreign travel, returned home at the end of June, 1822, and his father's objections being at length waived or conquered, he was married to Lady Emily Herbert on October 4, 1822. Lady Emily was beautiful,<sup>2</sup> graceful, accomplished, a great reader of poetry, theology and science, and an artist at least in knowledge and feeling (she was a pupil of Copley Fielding). The central feature of her character was a remarkable combination of strength and tenderness. She was throughout an affectionate and helpful supporter of her husband, and her influence for good over her brother-in-law Edward was hardly less conspicuous.

During the early years of their marriage, Pusey and his wife lived for some time at Rome, in the Palazzo Aldobrandini, where they made the acquaintance of the Chevalier Bunsen. Pusey left behind him a memorial of this sojourn in his presentation of a pedestal for the font in the German Chapel at Rome, with groups in relief by Thorwaldsen.<sup>3</sup>

On April 14, 1828, the Hon. Philip Pusey died, and his son came into possession of the family estate, though he did not commence residence at Pusey for two years afterwards. He appears at first to have interested himself in financial questions, for he wrote to his father-in-law, the Earl of Carnarvon, two letters on the Sinking Fund, and on Sir Robert Peel's financial statement of February 15, 1828, which were published as pamphlets in 1828. On the retirement of Mr. Henry Bonham early in 1830, he stood for Parliament at Rye, and was returned on March 1, 1830. His triumph was, however, short-lived, as on May 17 his election was cancelled at the instance of a Committee presided over by Lord Palmerston. The death of George IV. gave him another chance; and in the first Parliament of William IV. he was chosen (July 30, 1830) as one of the two members for Chippenham. During the Reform agitation he wrote a pamphlet entitled "The New Constitution," which was described by the "Quarterly Review" (vol. xlv. p. 289) as "one of the best both for reasoning and language that

<sup>1</sup> Mr. Pusey was always tenderly attached to Lord Carnarvon, and the death at Pusey of his brother-in-law and early college friend in the autumn of 1849 was one of the great sorrows of Pusey's life.

<sup>2</sup> Her portrait appeared in one of the Books of Beauty of the time (*Burke's Portrait Gallery*, 1833, ii. 116).

<sup>3</sup> A woodcut of this pedestal appears on p. 373 of vol. i. of *Bunsen's Memoirs*, and the text of the Latin and German inscriptions is given on p. 374.

have appeared at this crisis. . . . The outburst of fresh talent on the Conservative side, since these struggles began, has indeed been splendid."

At the general election in April 1831 Pusey lost his seat for Chippenham; but he returned to the House in July 1831, as member for Cashel, and it is curious that his one contribution to the debates of this Parliament was in defence of his old borough of Chippenham. In the first reformed Parliament he attempted to secure the third seat given to the county of Berks under the Act of 1832, but was unsuccessful, the two old members being returned, with Mr. John Walter; Pusey, the last on the poll, being, however, only 39 votes behind. In 1835 he became member for Berks, and retained that position through four Parliaments, up to July 1852. In his address to the electors in 1835 Pusey "thought it very important to call attention to 'the difference between the object of the Church, and the form of its constitution or legal architecture.'"<sup>1</sup>

As already stated, Pusey took in 1838 a prominent part in the formation of the Royal Agricultural Society, with whose interests he was afterwards so closely identified, and the organisation of which, no doubt, gave an agricultural bias to his mind. At the annual dinner of the Smithfield Club held on December 11, 1837, the President (Earl Spencer)—better known as Lord Althorp—mooted the project of a new Society for the encouragement and development of British agriculture. The idea was supported by the Duke of Richmond, Mr. Handley, M.P., and others; and early in May, 1838, advertisements appeared in the morning papers calling a public meeting to consider the establishment of an English Agricultural Society. This notice was influentially signed, and the meeting, held on May 9 at Freemasons' Tavern, was crowded to excess. Earl Spencer was in the chair, and amongst the other speakers were the Duke of Richmond, Earl Fitzwilliam, Lord Portman, Sir Robert Peel, Sir James Graham, Mr. Handley, M.P., Mr. Shaw Lefevre (Viscount Eversley), and Mr. Pusey. Pusey was a member of the original Committee of Management, which at once set to work, and at the General Meeting of members, held in December, referred to the proposal to establish a Journal for

<sup>1</sup> He was also anxious to promote the "reconversion of Dissenters," and with this view to substitute Milman's hymns for those of Sternhold and Hopkins in the Church services. He and his brother Edward—whose sympathies were warmly enlisted on the side of Sternhold and Hopkins—had quite a controversy on this subject; and it is curious that the lay brother Philip should have set himself to write several hymns, the best known of which is "Lord of our life and God of our salvation," the authorship of which few suspect (see Liddon's *Life of E. B. Pusey*, vol. i. p. 299).

“the diffusion of agricultural information.” The management of this Journal was entrusted to a Committee, of which Mr. Pusey was elected Chairman; but from the first the editorial control was placed exclusively in his hands. Mr. Pusey was already a Quarterly Reviewer,<sup>1</sup> and the Journal was modelled somewhat on the lines of that review, and was placed in the hands of Mr. Murray as publisher. Even as early as 1844 the Journal had made its mark, for the “Quarterly Review” (lxxiii. p. 481) said of it:—

The Journal of the Royal Agricultural Society of England will be a permanent monument to the honourable member for the county of Berks, whose patriotic earnestness of purpose induced him to take on himself the gratuitous labour of its editorship. The same spirit of zealous endeavour to assist in teaching the farmers of England to meet the necessities of the times has prompted Mr. Pusey, not only to prepare for the press the contributions of others, but also to enrich its pages with several most instructive articles from his own skilful pen on the recent improvements in agriculture, and on its actual condition in some of our counties where it is most advanced.

And Earl Cathcart, Chairman of the Journal Committee at a later date, observed in 1874 that

Mr. Pusey's agricultural life may find a fitting monument in the Journal. He edited the Journal from the first, and until his lamented and premature decease in 1855. A man of high character and sober judgment, Mr. Pusey was at once a philosopher and a man of business; a man in advance of his age. “Practice with Science,” the motto of the Society, his characteristic and oft-repeated words, even he thought more desirable than probable. Pusey was a natural leader of men, endowed by nature with that indescribable essence called genius.<sup>2</sup>

As Lord Cathcart suggests, “Practice with Science” was, at the time of the Society's formation, more an aspiration than a reality. It is true that long before that date Sir Humphry Davy had tried to join science in close connection with the practice of agriculture; but, interesting as were the lectures of Davy, and the researches of Saussure and of Boussingault, there was only imperfect knowledge of the nutrition of plants, or even of the materials necessary for their growth. Such knowledge could not, in fact, arise until chemists had more complete acquaintance with the mineral constituents of plants derived from the soil, and other elements concerned in the nutrition of plants. It was in the year 1840 that Liebig published his famous book on the Chemistry of Agriculture,<sup>3</sup> a work from

<sup>1</sup> See Smiles' *Murrays*, vol. ii. p. 378.

<sup>2</sup> Journal R.A.S.E. 2nd series, vol. x. 1874, p. 527.

<sup>3</sup> Liebig's *Organic Chemistry in its Applications to Agriculture and Physiology*, published in Brunswick, 1840. English edition, edited by Dr. Lyon Playfair, London, 1840.

the appearance of which, as Sir John Lawes said in 1851,<sup>1</sup> "we may date a spirit of investigation into Agricultural Chemistry such as had not previously been manifested in this country." On the publication of this epoch-making work Pusey, with all the earnestness of his nature, determined to make the motto of the Society not merely a name, but a reality. He cultivated the friendship of Dean Buckland, the geologist, Baron Liebig, Sir Richard Owen, Dr. Lyon Playfair, and other scientific men, and frequently gathered them together at his own house in the country to induce them to bring their science into more intimate relation with agricultural practice. He co-operated with Lord Ducie, Lord Spencer and others who were imbued with the same desire to join science and practice. It was chiefly at the suggestion of Mr. Pusey that several scientific men associated in a tour throughout the country, and addressed gatherings of farmers in such houses as those of Sir Robert Peel, Lord Fitzwilliam, and many others. As these gatherings of farmers were addressed on science in relation to agriculture by the associated tourists—Baron Liebig, Dr. Buckland, Dr. Daubeny, and Dr. Lyon Playfair—considerable interest in the subject was excited throughout the country, and the Society, which was then in its infancy, received a considerable impetus.

The early history of the English Agricultural Society (which blossomed forth in 1840 with a Royal Charter under the title of the Royal Agricultural Society of England) has already been told in these pages.<sup>2</sup> So also has its first historic meeting, held at Oxford on July 17, 1839.<sup>3</sup> Earl Spencer was the President at this meeting, and took the chair at the Annual Dinner, when Mr. Pusey was amongst the speakers. On March 26, 1840, the Queen granted the Society a Charter of Incorporation, the Duke of Richmond being named therein as the first President of "the Royal Agricultural Society of England." But at the first general meeting held after the granting of the Charter, Mr. Pusey was nominated as President by Earl Spencer, who said: "The question is, in selecting your President, will you look to rank and station only, or will you look to the working capabilities of the individual? My opinion is that the President of the Society should be a working man." Mr. Pusey thus came into office after the Society's meeting held at Cambridge on July 15, 1840, and retired from the presidency after the meeting held at Liverpool on July 21–23, 1841, being succeeded by Mr. Henry Handley. At a later period of his

<sup>1</sup> Journal R.A.S.E., vol. xii. (1851), p. 1.

<sup>2</sup> *Ibid.* 3rd series, vol. i. 1890, pp. 1–19.

<sup>3</sup> *Ibid.* 3rd series, vol. v. 1894, pp. 205–234.

life (in 1853) he was again elected President, but was unable to attend the annual meeting at Lincoln in 1854 on account of the serious illness of his wife.

Undoubtedly the six or seven years following 1838 were the happiest and most prosperous of Mr. Pusey's career. He was then in the prime of his life. He met on terms of intellectual equality all the leading thinkers and public men of the time. If he intervened in a debate in Parliament, the Minister who replied paid a little compliment to his sincerity, or his ability, or his knowledge of the subject. He breakfasted with Samuel Rogers and Monckton Milnes. He entertained Lord Spencer, Sir Robert Peel, Gladstone, Carlyle, Bunsen, Whewell, Grote, the Bishop of Oxford (Wilberforce), and many more. He attended the meetings of learned societies (he became a F.R.S. on May 27, 1830). He was to be seen at the Athenæum and the Travellers', and was a member of the more eclectic Grillion Club. He was one of the founders of the London Library in 1840, and a member of the original committee. He discussed Plato and Demosthenes with the scholars, religion with the theologians, and agricultural improvement with the chemists and farmers. He wrote on philosophy for the "Quarterly Review," on current topics for the "Morning Chronicle," and upon farming for the Journal of the Royal Agricultural Society.

Bunsen—with whom he had already formed an acquaintance at Rome—came to England for the first time in 1838, and spent a great deal of time with the Puseys as their guest in Berkshire and in London. Bunsen's memoirs of this period are full of references to "dear Pusey." *Apròpos* of a meeting between Pusey and Arnold, Bunsen writes to his wife on February 13, 1839, "I wish I could give you an adequate idea of the love and admiration I feel for Pusey; admiration for his extraordinary statesman-like judgment, wherever he is, on the ground of his Parliamentary life and business, in which he moves as a fish in the water; not less, for his admirable temper and character."<sup>1</sup> Later he speaks of Pusey and himself (there being no debate in the House), "remaining together and reading Sophocles, which cheered the good friend considerably"; of a discussion between Pusey and himself, lasting all the afternoon, on the chronology of St. Paul's Epistles, and the authorship of the Acts of the Apostles; of breakfasting with Pusey upon "ham and speculative philosophy." And again: "Pusey is a most unique union of a practical Englishman and an intellectual

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<sup>1</sup> *Memoirs of Baron C. J. Bunsen*, vol. i. pp. 504, 507, 508, 522.

German, so that when speaking in one capacity, one might think he had lost sight of the other."

In 1843 Pusey had made a visit to Scotland, to study for himself the Scottish Poor Law system, and he gained some credit by a pamphlet on "The Management of the Poor in Scotland," which he published in 1844, and which criticised the recommendations of a Royal Commission appointed in 1843. He appears to have thought that a similar inquiry on the spot as to the condition of the Irish people would be useful; and in 1845 he projected with Mr. Gladstone a riding tour through Ireland. Owing to family matters, Mr. Gladstone had to break off the engagement, "thereby," as he said in a letter dated December 6, 1894, to Mr. Pusey's son Sidney, "postponing for a long time my acquiring a real knowledge of Ireland." Dr. Pusey, writing to Mr. Gladstone on September 3, 1845, spoke of his brother's bad spirits about giving up his Irish tour, and added, "I am very sorry for it, for I had looked forward with great pleasure to his having such an employment for his mind, and to his travelling with you. It is sad to think of his clear mind left without any adequate occupation, to waste itself, because it has none, and that he might do much for the moral restoration of our land, and no one employs him. I think Sir R[obert] P[eel] has made a miserable mistake in not finding out some unpaid employment in which he might turn his clear mind to good account."<sup>1</sup> With reference to this remark, it may be stated on the authority of an unpublished conversation which Bunsen had in 1855 with Mr. Pusey's daughter, that Peel was designing at the time he was so dramatically hurled from power in 1846 to appoint Pusey his Chancellor of the Exchequer.

Pusey did not take a prominent part in the discussions in Parliament on the Corn Laws, and, indeed, he was absent from the two critical divisions on the second and third readings of Sir Robert Peel's Bill of 1846. But as a personal friend of Sir Robert, there is little doubt that he followed him in his change of opinion; and thus, though Pusey was re-elected for Berks without opposition at the General Election of 1817, as a Liberal Conservative, he had to face a growing discontent amongst his constituents. During the first four sessions of the Parliament of 1847-52, he tried to interest the House of Commons in the subject of Tenant Right, of which indeed he became the champion. In 1843, 1844, and 1845, Lord Portman had introduced into the House of Lords Bills designed to secure for an agricultural tenant compensation for unexhausted improve-

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<sup>1</sup> Liddon's *Life of E. B. Pusey*, vol. iii. p. 168

ments; but they did not meet with much sympathy from the Upper House, so that Pusey prepared a very modest measure, which he submitted to the House of Commons. It was a private member's Bill; it was attacked vehemently by Colonel Sibthorp and other members of the same school; in 1847 it was withdrawn; in 1848 Mr. Newdigate forestalled Pusey by moving for a Select Committee to consider the whole subject; in 1849 the Bill passed the Commons, and got as far as a second reading in the Lords; in 1850 it again passed the Commons—much mutilated—and in the Upper House Lord Portman moved, not very enthusiastically, the second reading. Lord Beaumont, however, thought<sup>1</sup> “the Bill so objectionable that it was not worth going into committee upon,” and it was resolved, without a division, that it be read a second time that day six months.

Pusey did not try the fortunes of the Bill again, but the Select Committee of 1848, of which he was Chairman, collected a body of evidence, and presented a report of great value, which, after a lapse of twenty-seven years, reaped its reward. Mr. Disraeli, in moving the second reading of the ministerial Agricultural Holdings Bill on June 24, 1875, paid a warm tribute to Mr. Pusey's exertions in the matter, observing that “Mr. Pusey was the first person to introduce into this House the term ‘tenant right,’” and detailing his efforts towards legislation on the subject. The Prime Minister observed: “When he ultimately relinquished the struggle, he said to me, ‘it was the only blot in the agricultural hierarchy,’—the fact that the tenant-at-will had no security for the capital which he ought to be encouraged to invest in the soil.” And Mr. Disraeli added—what is perhaps Pusey's best eulogium—“Mr. Pusey was, both by his lineage, his estate, his rare accomplishments, and fine abilities, one of the most distinguished country gentlemen who ever sat in the House of Commons.”<sup>2</sup>

It is significant that the original champion of Farmers' Tenant Right should have been a typical landowner; but the fact is that at the time of the original agitation for the alteration of the law of agricultural tenures, the demand did not proceed from the tenant farmers. It is clear from Pusey's writings that the soil in different parts of the country urgently needed improvement in various directions, such as draining, marling and chalking, and that a magnificent return was anticipated for those who embarked their capital upon such operations. Indications of the groove in which Pusey's mind was running on the subject of

<sup>1</sup> Hansard, vol. cxli. p. 855.

<sup>2</sup> *Ibid.* vol. ccxxv. pp. 450-7.

Tenant Right are to be found in his early writings in the Journal. Thus he remarks in 1842: "If I were a working farmer, nothing would induce me to enter on a cold wet farm unless there were a fair prospect of its being drained either with my own money on a long lease, or with the aid of my landlord. Our Society has wisely abstained from entering into questions between landlords and tenants."<sup>1</sup> Giving concrete instances of the profits to be derived from chalking and marling, and referring to these and other practices, Pusey asks, "Why, then, is not each universally carried out upon every acre of land within its own limits? This is a difficult question to answer. In some degree none of us carry out all that is in our power; but want of capital and want of confidence in the tenure of farms are, I suppose, the two principal causes of this omission."<sup>2</sup>

And in 1844, the following reference to the subject of Tenant Right, signed "Ph. Pusey," was appended as an editorial footnote to an article by Mr. Barugh Almack on the Agriculture of Norfolk:—

These covenants in Lord Yarborough's agreements as to unexhausted improvements are merely just to the tenant in securing to him the money he has sunk in his farm. They have practically succeeded in producing very great improvements where they have been adopted. They are also accompanied by a clause in the landlord's favour, binding the tenant to purchase artificial manures for the whole of his turnip crop. The absence of capital from land where it might be profitably employed has been long lamented, yet few landlords have funds at command for the general improvement of their estates. I can see no means so likely to supply this old defect, and to bring England generally into the condition of Lincolnshire, as the adoption of Lincolnshire Covenants. The subject of unexhausted improvements seems to me the most important of all Agricultural subjects for landlords at present, and the improvement of our agreements in this respect to be a condition *sine quâ non* of any steady and general improvements of the soil or its cultivation.—PH. PUSEY.<sup>3</sup>

It is important to note that these remarks were made some years before the question of the repeal of the Corn Laws had come within the range of immediately practical politics. The sudden conversion of Sir Robert Peel on this subject (in which Pusey followed him) gave a great impetus to the question of Tenant Right, still rather as a question affecting the improvement of the land, than as a matter of abstract justice to the tenant; and landowners of Pusey's enlightenment began to feel that their one salvation from the effects of the repeal of the Corn Laws lay in the improvement of their farms through the

<sup>1</sup> Journal R.A.S.E., vol. iii. 1842, p. 172.

<sup>2</sup> *Ibid.* p. 185.

<sup>3</sup> *Ibid.* vol. v. 1844, p. 348.

judicious application of capital. In Pusey's own words, written in 1850: "Agricultural improvement, which might hitherto be looked on as a hobby for a few country gentlemen, is now become the unavoidable business of landowners generally."<sup>1</sup>

Although Pusey's early efforts to obtain legislation on the subject of Tenant Right failed, the Report of the Agricultural Customs Committee in 1848 has formed the basis of all subsequent legislation in England and Scotland on that subject, and it led almost immediately to the passing of the Landlord and Tenant Act, 1851, which permitted a tenant to either remove farm buildings or fixed agricultural machinery that he might have erected with the consent of his landlord, or to obtain from the landlord at his option the price of their value ascertained by two referees chosen from each party or by an umpire chosen by the referees. The principle of this procedure is still part of the present Agricultural Holdings Act. By the same Act of 1851, the claims of the tenant to emblements or growing crops, which formerly were determined by the death of the landlord, became practically a charge upon the estate.

Pusey's Agricultural Customs Committee was the means of giving publicity to the excellent custom as to compensation for unexhausted improvements which then prevailed in Lincolnshire. The Committee reported that the benefits arising from the Lincolnshire system of compensation were becoming more extensively known. Most of the witnesses before the Committee agreed in their recognition of the great value of the Lincolnshire custom, which in the words of one of the witnesses "sprang up voluntarily and extended from one side of that great county to the other, encouraging and materially improving the state of farms." The Committee reported that a "wider system of compensation for the outgoing tenant seems to be highly beneficial to agriculture, to the landlord and to the farmer; to lead to a great increase in the productiveness of the soil and to extended employment of the rural population."<sup>2</sup>

As already indicated, Pusey had previously recognised the excellence of the Lincolnshire custom; for particulars of it as practised on Lord Yarborough's estate were given by his agent in the *Journal* for 1845, and a letter from the Loughborough Agricultural Society also emphasised the excellence of the Lincolnshire system, stating that the Committee of that Society, "knowing the high state of cultivation to which many parts of Lincolnshire had been brought by the adoption of liberal Tenant Rights, determined upon recommending these suggestions for improved agreements as a most likely means of

<sup>1</sup> *Journal R.A.S.E.*, vol. xi. (1850), p. 381.

<sup>2</sup> Report of Agricultural Customs Committee, 1848, p. iv.

producing corresponding improvements in the Midland Counties.”<sup>1</sup> Pusey himself adopted the Lincolnshire custom for farm agreements on his own estate in Berkshire.<sup>2</sup>

At home Pusey was the ideal country gentleman. The Pusey estate consists of nearly 5,000 acres, the home farm (where he made all manner of agricultural experiments) being about 380 acres. The breeding and feeding of sheep was the point upon which everything else on the farm was made to hinge, and the great feature of the management was a system of water-meadows, introduced from Devonshire.<sup>3</sup> A full description of Mr. Pusey’s farming will be found in the late Sir James Caird’s fourteenth letter as Special Commissioner of “*The Times*” in 1851.<sup>4</sup> When in the country Pusey was up at six in the morning, supervising everything and everybody, and watching and superintending all the operations of the farm. He was an excellent landlord, and very thoughtful for the comfort of his labourers. He improved or rebuilt their cottages, obtaining the assistance of Mr. Street, R.A., in the designs. These cottages contained three bedrooms and two sitting-rooms, had a good garden attached, and were let for 1s. weekly. He provided the labourers with allotments; he organised works to keep them in constant employ; and on one occasion, in 1849, when the bakers asked 10d. for a so-called quartern loaf, he set up a bakery at Pusey House, and sold for some time an enormous quantity of loaves to his labourers at 7½d. per quartern, continuing this until the bakers lowered their prices and gave good measure.

His associations with the Royal Agricultural Society kept him abreast of the latest ideas as to the scientific practice of agriculture, and he tried innumerable experiments, ploughing up a part of his park for the purpose. The house at Pusey was seldom long without a visit from some agriculturist, home or foreign; and there were periodical parties of scientists. At intervals there were trials of implements on the estate, when the place was full of farmers and implement makers, and when Pusey, as organiser-general, was thoroughly in his element. The most important of these trials were in October 1845, of ploughs, drills and tile machines, for the prizes offered by the Royal Agricultural Society; in April and August, 1851, of ploughs, drills, and reaping machines, &c. for the medals of the Great Exhibition, when M’Cormick’s reaping-machine was first introduced into this country, and excited universal interest; and in August 1853, of reaping-machines again. Mr. Pusey was a

<sup>1</sup> *Journal R.A.S.E.*, vol. vi. 1845, pp. 44-48.

<sup>2</sup> *Ibid.* vol. vii. 1846, p. 234.

<sup>3</sup> *Ibid.* vol. x. 1849, pp. 462-479.

<sup>4</sup> Caird’s *English Agriculture in 1850-1*, pp. 107 et seq.

good shot, better (despite Dr. Liddon) than his brother Edward; he was one of the best whips in England, and drove four-in-hand over the Alps; he had a good seat on a horse, but was not a very bold rider; a follower of the hounds, though not particularly keen on fox-hunting; and fond, in his earlier days, of coursing. It may be added that he was a great connoisseur of art, and took an important share in the establishment of the National School of Art, and that he made a valuable collection of prints and engravings, as well as of autographs.

The last important piece of work to which Pusey put his hand was the organisation of the Agricultural Implement Section of the Great Exhibition of 1851. He was Chairman of this section, and as a Royal Commissioner came much into contact with the Prince Consort, who had a high opinion of his ability. On Midsummer Day, 1851, a date still green in the memories of the few surviving cottagers at Pusey, he brought some 500 of his labourers to London to see the great show. A silver snuff-box, presented to Pusey in memory of this visit, was greatly valued by him; and there is still in almost every cottage at Pusey an engraving with his portrait and autograph and a representation of the snuff-box beneath. The report which he wrote on the Implement Section of the Exhibition—printed in the reports of the Royal Commission and reproduced in Vol. XII. of this Journal—is justly esteemed as a masterly production.

It was during one of his visits to London, in May, 1851, on the business of the great Exhibition, that the unpleasant rumour reached Pusey that a requisition had been made to Mr. Vansittart, a Protectionist and ultra-Protestant, to stand against him in Berkshire. After the Derby Ministry came in, early in 1852, Mr. Vansittart issued an address, to which Pusey replied by a manifesto giving his reasons for "declining to join in an agitation for the revival of protection to agriculture," and asking for a renewal of support. But a section of his constituents were out of sympathy with his views on the Corn Laws; his vote in favour of the Maynooth College grant was used against him; and his relationship to the great apostle of the High Church movement—who was just then particularly active—was thought to influence him in favour of "Romish practices." In a letter to one of his supporters Pusey says: "I hear that among electioneering tricks some call me a Puseyite. I am no more than Lord Shaftesbury is; but I will not consent to find fault with my brother in public." When Parliament was actually dissolved in July, 1852, Pusey issued another address; but on the very eve of the election he withdrew his candidature, recognising the impossibility of success. He wrote on July 12, 1852, a dignified valedictory address, in

which he said:—"Protection has this year fallen ridiculously, not by the assault of its enemies, but the desertion of its supporters. Whether the dreams of other relief will be realised, a few weeks will show; but in any case the farmers will soon discover what blind guides they have followed. Improvement, on the other hand, has more resources than ever to offer; and its loudest opponents, stepping from the heights of their eloquence, must soon pay to it a silent tribute by consenting to purchase new manures and less uncouth implements. Chemistry and mechanism have beaten politics and protection."

His arduous and sustained public labours over so long a period, and his domestic troubles, began at this time to have a serious effect upon Pusey's constitution. The health of his wife had been for some years a source of anxiety to him, and in May 1852 it was made worse by her terrible distress at the painfully sudden death of the Hon. Edward C. H. Herbert, her only surviving brother, who practically lived at Pusey. Although a start was made in August 1852 on a continental tour, both Pusey and his wife were ill at Paris, and had to return. During the winter of 1852-53 he was unwell, with attacks of gout and fainting fits, and in September 1853 a tour in Scotland was spoilt by his ill-health. Meanwhile his wife, whose lungs were seriously affected, was getting worse, and Pusey was unwilling to leave her to attend his usual public avocations, no doubt recognising, moreover, that he himself was not the man he was.

Some amount of solace may have been given to Pusey in 1853 by the conferring of the honorary degree of D.C.L. upon him by his old University of Oxford, which (after a fashion not uncommon at that time) he had left in his undergraduate days without taking a degree. Moreover, his colleagues on the Royal Agricultural Society elected him for a second time as President of the Society. His spirit, however, appears to have been broken, and all energy to have left him. On April 24, 1854, Lady Emily wrote in her diary: "It is clear that Dr. Acland thinks there is no hope but of protracting my life a little longer."<sup>1</sup> Mr. Pusey would not leave her, remaining by her bedside, so that the Lincoln Meeting of the Royal Agricultural Society, of which he was President, had to take place without him. The end came at last on November 13, 1854, when Lady Emily "fell gently asleep." Mr. Pusey was heart-broken. He could attend to nothing. After the funeral Dr. Acland advised a change of air, but as Pusey would go nowhere without his brother, and Dr. Pusey could not leave Oxford, he

<sup>1</sup> Liddon's *Life of H. B. Pusey*, vol. iii. p. 411.

begged to be taken to Christ Church. The spacious drawing-room and adjoining bedroom, traditionally associated with Wolsey while at Oxford, were placed at his disposal; but he had not been more than a week at Christ Church when he was stricken with paralysis. He never left his bed afterwards, though his mind was still very active, and he took the deepest interest in the events of the Crimean war, which was then raging. During his illness several old friends came to see him, amongst them Lord Stanhope, the historian, the Dowager Duchess of Argyll and Mr. Gladstone (then Chancellor of the Exchequer). The latter questioned Dr. (now Sir Henry) Acland—the family friend and medical adviser—closely about Pusey's state, and said that in the event of there being any hope for his life, the Government would recommend him to Her Majesty for a peerage. But there was unhappily no hope, and after a second stroke Philip Pusey died, at the early age of 56, on July 9, 1855.

His long withdrawal from the public eye during his weary illness perhaps accounts for the little notice of his death that was taken at the time; but the Royal Agricultural Society, at a weekly Council held two days afterwards, on July 11, 1855, received "with deep emotion the announcement of the death of their distinguished member, Mr. Pusey, whose name and labours will remain imperishably associated with the foundation, development, and successful progress of the Royal Agricultural Society of England, to whose interests, and to those of the agricultural community in general, his whole time and energies were so entirely and successfully devoted." Subsequently, the Council, on the motion of Lord Portman (then President), seconded by Colonel Challoner and Mr. Raymond Barker, passed unanimously, on November 7, 1855, a resolution "that a letter be written to the family of the late Philip Pusey, Esq., expressing the gratitude of the Royal Agricultural Society of England for his services as Chairman of the Journal Committee, and their great sorrow for his early death. That it be engrossed on vellum and signed by the President, with the seal of the Society attached."

To Lord Portman's letter conveying the sentiments of the Council, Mr. (afterwards Sir Thomas) Acland, one of Mr. Pusey's executors and dearest friends, replied on behalf of the family in a letter dated December 12, 1855, which thus admirably sums up his character and services:

"Of Mr. Pusey himself, it will long be remembered that to practical habits of business he joined deep philosophical thought, accurate scholarship, and genial appreciation of the arts and letters of modern as well as ancient times—that he applied a powerful intellect with a keen forecast of the wants of his

country, to develop the resources of British farming—and that by a rare union of endowments he did much to render science practical and to win for agriculture a worthy place among the intellectual pursuits of the present day. How much labour he underwent, what forbearance and discrimination he exercised, how considerate he was of the feelings of others, how modest in the expression of his own, may never be known except to his personal friends; but some of the results of his unceasing exertions during many of the best years of his life are to be found in the *Journal*; and by that *Journal* at least his name will be permanently and honourably connected with the Society from the date of its commencement.”<sup>1</sup>

Mr. Pusey left one son, Sidney (born September 15, 1839) the present proprietor of Pusey, and two daughters, Edith-Lucy and Clara, married to Captain Francis Charteris Fletcher, whose son Philip Francis Fletcher is heir-presumptive to the estates. Pusey was about five feet ten inches in height. He was fair-haired, with clear blue eyes, and had a prominent nose. His daughter, Mrs. Fletcher, has a striking miniature of him taken as a young man; there is a not very good painting of him at about the same age at Pusey, where also is a large crayon drawing of him in his prime, by George Richmond, from which the frontispiece to this memoir has been reproduced. (An etched reproduction of this on a smaller scale was done by F. C. Lewis for the collection of portraits of the Grillion Club.) Pusey appears in the large engraving of the Royal Agricultural Society made by Reynolds in 1842, from the picture by Richard Ansdell, now in the Peel Park Museum at Salford. Ansdell's original study of Pusey, which is preserved at 13 Hanover Square, depicts him facing the spectator in a characteristic attitude with a stick in his hand, and attired in the frock-coat, buff waistcoat, stock, and strapped trousers of the period.

It remains only to speak of Mr. Pusey in his literary capacity, and as Editor of this *Journal*. Sir James Caird, in his article on Agriculture in Mr. Humphry Ward's “Reign of Queen Victoria” (1887), speaks of Pusey as “the leading agricultural writer of his day.” So, indeed, he was, although his contributions to agricultural literature took the form rather of practical articles on particular questions of the moment than of finished monographs on departments of the whole subject. In addition to the pamphlets already referred to on the “Sinking Fund” and “Sir Robert Peel's Financial Statement”

<sup>1</sup> The full text of the Council's resolution, of Lord Portman's letter, and of Sir Thomas Acland's reply, will be found on pp. 607-8 of vol. xxvi. of the *Journal* (1855).

(1828); the "New Constitution" (1831); "The Management of the Poor in Scotland" (1844); and a pamphlet of 1851 entitled "The Improvement of Farming: What ought Landlords and Farmers to do?" the only works or articles to which his name was appended appeared in the successive volumes of this Journal, though he was, as already stated, a Quarterly Reviewer, and a contributor to the "Morning Chronicle."

The total number of articles which Pusey wrote for the Journal of the Royal Agricultural Society was forty-seven, many of which were on minor questions—as to the application of particular kinds of manure, different systems of cultivation and drainage, agricultural implements and crops, the breeding and feeding of sheep, &c. His more important articles were on "The State of Agriculture in 1839," and "An Experimental Enquiry on Draught in Ploughing" (Vol. I., 1839); "Progress of Agricultural Knowledge during the last four years" (Vol. III., 1842); "Agricultural Improvements of Lincolnshire" (Vol. IV., 1843); "Theory and Practice of Water Meadows" (Vol. X., 1849); "Progress of Agricultural Knowledge during the last eight years" (Vol. XI., 1850); "Report on the Agricultural Implements at the Great Exhibition" (Vol. XII., 1851); "Source, Supply, and Use of Nitrate of Soda for Corn Crops" (Vol. XIII., 1852); and "Nitrate of Soda as a Substitute for Guano" (Vol. XIV., 1853).

If the facts recorded in these articles seem a little out-of-date now, they may still be read with pleasure for their scholarly and vigorous English. To attempt a summary of them would be to invite a comparison at every turn between the state of agricultural affairs then and now—which is not the purpose of this article. Some of Pusey's forecasts were right and some were wrong; but no one can question the pains he took to arrive at a right conclusion in every matter which he discussed in print, or the care and patience he bestowed as Editor in polishing and improving the articles submitted to him by his manifold contributors.

Perhaps his labours for the Journal are best summed up in a letter which the late Lord Playfair (who in his younger days was a friend and disciple of Pusey) addressed to me shortly before his death in 1898:

"Through the Journal Mr. Pusey always devoted his efforts to keep Practice and Science in close connection, and the pages of the Journal from that period to the present time show that it has been maintained on the lines laid down so wisely and sagaciously by its first Editor."

ERNEST CLARKE.

13 Hanover Square, London, W.

## THE FOOD SUPPLY OF THE UNITED KINGDOM.

IN a paper read by me at a recent meeting of the Royal Statistical Society<sup>1</sup> an attempt was made to throw some light on the question as to the possibility of producing from the soil of this country sufficient food to meet the primary wants of the population. Considerable uncertainty on this point is evident in much that has been published on the subject of the nation's provision of food, and, in labour and other circles of advanced social reform, the opinion is frequently expressed that our dependence upon external sources of supply might be extinguished by assimilating our systems of farming and tenure to those prevailing abroad, and by the cultivation of "waste land," the location of which is seldom specified. This view is usually found to be associated with the idea that "food" is synonymous with "bread," and there has been too great a tendency to treat the question solely in relation to the supply of the so-called Staff of Life. But an examination of the Agricultural and Trade Returns shows, on the one hand, that our production of wheat can no longer be taken as the principal measure of the contribution from the home agriculture to our food requirements, and, on the other hand, that our imports of this cereal do not afford an adequate indication of the area of cultivable waste land which must be discovered to meet the deficiencies of our own resources. It will be found that an investigation of the problem of the food supply of the people involves, in these days of cheap food, the consideration of a dietary embracing a number of viands, among which bread occupies a place determined more often than was formerly the case by the choice of the consumer. So that an inquiry into our position as a self-sustaining nation should extend, at least, to such fundamental articles as meat, potatoes, and milk, as well as to bread.

With regard to bread, the publicity given in 1898 to the report of the National Committee on Wheat Stores, and more recently to the speculations of an eminent scientific authority on what is sometimes called the "wheat problem," must have

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<sup>1</sup> *Journal of the Royal Statistical Society*, Vol. lxii., Part iv. 1899.

acquainted most of us with the bareness of the national bread-cupboard. It is now common knowledge that we obtain from transmarine sources over three-fourths of the wheat necessary to meet the demands of the population; or, in other words, our own production of this grain represents less than one quarter of every loaf of bread consumed in the country. The position may be more clearly appreciated when it is explained that in the five years 1894-98 the average annual supply of wheat available for consumption in the United Kingdom amounted to 233,000,000 bushels, of which the home production, after allowing for seed, is estimated to have furnished 54,000,000 bushels, the remaining 179,000,000 bushels having been made up by imported grain.

In the case of meat we are less dependent upon external sources of supply. Our average annual provision of beef, mutton, and pork is estimated to have amounted in the quinquennium to 2,231,000 tons, consisting of 1,387,000 tons of home-grown meat and 844,000 tons imported. In connection with this estimate it is to be noticed that the home production is based on the assumption that for every 1,000 living cattle of all ages, enumerated annually for the purposes of the Agricultural Returns, about 67 tons of beef and veal are available for consumption in a year; for every 1,000 living sheep enumerated, 12½ tons of mutton and lamb; and for every 1,000 living pigs, 69½ tons of bacon, ham or pork.<sup>1</sup> The weight of dead meat represented by imported live animals has been calculated from the average weight of meat furnished by each description of animal imported. The quantities arrived at in this way show for the period 1894-98 an average annual consumption of meat of all kinds of about 127 lb. per head of the population, this ration including roughly 60 lb. of beef, 31 lb. of mutton, and 35 lb. of pork. (With respect to these figures it may be mentioned here that Mr. Turnbull, who has devoted much attention to this question of meat consumption, is of opinion that the methods of calculation pursued exaggerate the quantity obtained annually from the home live-stock. The subject is discussed by him in an article published in the "Land Agents' Record" of January 27 last.<sup>2</sup>) A review of the statistics relating to the meat supply during the past twenty years, would

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<sup>1</sup> A memorandum explaining the methods of calculation employed in arriving at these figures is contained in the Appendix to the Report of the Select Committee on the Agricultural Produce (Marks) Bill, H.C. 365.

<sup>2</sup> Mr. Turnbull believes that the annual average consumption of beef, mutton, and pig meat has never exceeded 122 lb. per head of the population, and that in 1898 it was 120 lb. per head.

appear to show that there has been practically no diminution in the home contribution; for while it is true that our own production has not kept pace with the growth of population, it does not, as in the case of wheat, exhibit an absolute decline. The rise in the consumption of meat is due entirely to the steadily increasing consignments to our markets from abroad, and as the greater portion of these receipts consists of grades inferior in value to the home produce, it may be inferred that the imported, cheap meat has satisfied, for the most part, a demand among classes to whom the article was formerly more or less a luxury.

The facts relating to potatoes are even more encouraging. Of these nourishing esculents we produce almost a sufficiency, our own contribution to the supply in 1894-98 amounting to an annual average of approximately 4,900,000 tons out of a total yearly provision of 5,130,000 tons. It may be of interest to note that an examination of the records of the production and imports since 1884 would seem to indicate that the potato is losing some of its popularity as an article of diet in this country. The consumption per head has apparently decreased by about 12 per cent., and although this drop may be connected with the decline in the numbers of the poorer population of Ireland, the diminution in consumption is greater than could be explained by the loss of consuming power consequent upon emigration from that part of the kingdom. Confirmatory evidence of this change is forthcoming in the last report of the Commissioners of National Education, wherein it is stated that the cheapness of foreign flour has done much to reduce the value of the potato in the diet of the Irish peasantry; "a bit o' cake bread and a drop o' tay" is now their common meal.

Of the products defined above as fundamental articles of food, only milk remains to be considered. Calculations of the home production of butter and cheese exist, but they are necessarily of a conjectural character, and it will be safer to show the consumption of all forms of dairy produce in terms of raw milk. On the basis of an average net yield per cow of 360 gallons, which is the estimate arrived at after careful inquiry by Mr. Rew in 1892, the average annual volume of milk furnished by the entire cow stock of the United Kingdom in 1894-98 was 1,428 million gallons. In the same period the net yearly imports of butter, cheese, and condensed milk represented, as raw milk, a total of 1,161 million gallons, thus bringing up the aggregate supply available for consumption from all sources to an average of 2,589 million gallons yearly. This quantity does not include the imports of raw milk and

cream, which are insignificant, nor does it include imported margarine, in the manufacture of which a certain proportion of milk is employed.

The results of the foregoing review of the statistics and estimates relating to the consumption of the four principal articles of diet may now be recapitulated in tabular form :—

*Average Annual Supply, United Kingdom, 1894–98.*

	Home production	Net imports	Total supply	Supply per head		
				Home	Imp't'd	Total
Wheat .	qrs. 6,744,000	qrs. 22,421,000	qrs. 29,165,000	lb. 82	lb. 273	lb. 355
Meat .	tons 1,387,000	tons 844,000	tons 2,231,000	79	48	127
Potatoes .	4,963,000	169,000	5,132,000	282	9	291
Milk .	gals. 1,428,588,000	gals. 1,160,674,000	gals. 2,589,262,000	gals. 36	gals. 29	gals. 65

The purpose of the preceding paragraphs has been to indicate, in the first place, the extent to which we are at present feeding ourselves so far as concerns such fundamental foodstuffs as bread, meat, potatoes, and milk; and, secondly, the extent to which we are fed by other countries. In the case of bread it has been shown that our own contribution in the form of wheat is equivalent to less than 25 per cent. of our annual consumption; of our yearly requirements of meat, we provide about 62 per cent; of milk, including butter and cheese, about 55 per cent.; and of potatoes, practically the whole. But this statement is obviously too favourable, inasmuch as we have yet to take into account the fact that the live stock of this country is largely maintained on feeding-stuffs grown abroad; and, moreover, our production of wheat, potatoes, and other crops is supported, in part, by imported fertilisers. Hence, to ascertain with some approach to the truth in what proportion the home agriculture is contributing to the needs of the population, and what is the measure of its deficiency, an allowance must at least be made for the large volume of raw material imported for conversion into meat and milk. There are, however, obvious difficulties in estimating the value of these imports in their converted form. A clearer view of the situation will be obtained by showing what area of land would be required in this country to produce our annual foreign supplies of wheat, meat, and milk, and of feeding-stuffs used in the production of the two latter articles. In this way our dependence upon external sources may be measured in terms of "acres."

Among imported articles used, wholly or partly, as feeding-stuffs, the principal are barley, oats, maize, beans, peas, oil-cakes, oil-seeds, and hay, and to these may be added the minor imports of rye, buckwheat, and meals of various kinds. The average annual net importation of these materials in the five years 1894-98 is shown below :—

*Average Annual Net Imports into the United Kingdom, 1894-98.*

	cwt.		cwt.
Barley . . . . .	24,012,000	Cotton-seed . . . . .	7,810,000
Oats (including oat-meal) . . . . .	16,461,000	Linseed . . . . .	7,317,000
Rye . . . . .	997,000	Rape-seed . . . . .	883,000
Beans and peas . . . . .	5,943,000	Linseed cake . . . . .	3,880,000
Maize (including maize-meal) . . . . .	43,741,000	Cotton-seed cake . . . . .	2,140,000
Buckwheat . . . . .	149,000	Other oil-cake . . . . .	120,000
		Hay . . . . .	2,870,000

It is difficult to arrive at any very exact appreciation of the volume of such products converted into meat and milk, inasmuch as a certain quantity of some of the articles enumerated is used for other purposes; and moreover the absence of statistics of the numbers of horses, other than those employed in agriculture, and of the numbers of poultry kept in this country, makes it impossible to arrive at any very satisfactory estimate of the amount of imported fodder consumed by these classes of live-stock as distinct from the consumption by cattle, sheep, and swine. The imports of feeding-stuffs must therefore be considered as a whole in their bearing on the maintenance of live-stock of all kinds, and not solely in their relation to the home production of meat and milk. The inclusion of horses and poultry will not seriously affect the results, since a large number of horses are employed in the cultivation of the soil upon which the food is produced, and may, therefore, be justly regarded as necessary agents in its production. As to poultry, the consumption of imported grain in poultry yards cannot be an item of any magnitude, and, in any case, the amount so consumed eventually contributes to the supply of human food. By the inclusion of horses and poultry, the only disturbing factors for which allowance need be made are the quantities of the several imported materials consumed in various manufactures.

Barley and maize are employed in brewing and other industries as well as for fodder. As to the former product, there can be little doubt that the grain received from Russia is almost entirely feeding-barley, and it is probable that some portion of the receipts from Roumania and Turkey are utilised in a similar direction. For the present estimate, then, it will be safe

to treat as feeding-barley the whole of the consignments from the first-named source. These, on the average of the five years, amounted to 11,947,000 cwt. In the case of maize some allowance must be made for the relatively small demand for the cereal in the manufacture of proprietary articles and confectionery, as well as in the brewing or distilling industries. It may be assumed that these purposes do not absorb more than 10 per cent. of the total supply. On this assumption, the average quantity of maize imported annually for consumption by live-stock amounted in the five years to 42,000,000 cwt.

Imported beans and peas include some varieties used for human consumption, but it will be quite safe to estimate the quantity employed as fodder as constituting at least 80 per cent. of the supply of each of them, and this gives us 4,754,000 cwt. From the imports of oats a deduction of 10 per cent. may be made for the small quantities used in proprietary goods and in other directions. Hay and oil-cake present few difficulties: the entire importation of these articles may be treated as forming part of the supply of feeding-stuffs.

Imported oil-seeds are largely employed in the manufacture of cakes and feeding-meals, after the greater part of the oil has been extracted. According to statements furnished in 1892 to the Departmental Committee on Fertilisers and Feeding-stuffs, the amount of cake produced from imported oil-seeds of all kinds represents approximately 50 per cent of the weight of the seed, so that it may be assumed with moderation that the production of cake is equivalent to at least 40 per cent. of the weight of the seed imported.

With the foregoing reservations and allowances, an estimate of the average quantities of the principal materials imported annually for the maintenance of the live-stock of the United Kingdom during the five years 1894-98, furnishes the following results:—

	Owt.	Busbels
Barley . . . . .	11,947,000	= 26,757,000
Oats . . . . .	14,815,000	= 42,546,000
Rye . . . . .	997,000	= 1,860,000
Beans . . . . .	2,785,000	= 4,837,000
Peas . . . . .	1,969,000	= 3,446,000
Maize . . . . .	42,067,000	= 78,525,000
Cotton-seed, as cake . . .	3,124,000	—
Linseed, " . . . . .	2,927,000	—
Rape-seed, " . . . . .	353,000	—
Linseed cake . . . . .	3,880,000	—
Cotton-seed cake . . . . .	2,140,000	—
Other oil-cake . . . . .	120,000	—
Hay . . . . .	2,870,000	—

It would appear, therefore, that we import annually nearly 90 million cwt. of feeding-stuffs for the maintenance of our live-stock, and of this quantity by far the greater portion is utilised in the home production of meat and milk. The point now to be determined is what this large importation represents in terms of acres; or, in other words, what area of land would be required to grow the whole of the imported fodder materials on the basis of the average yields per acre secured in the United Kingdom. The results of a calculation of this kind for feeding-grains and hay are shown below. The weight of a bushel of grain has been taken as 50 lb. for barley; 39 lb. for oats; 64½ lb. for beans; 64 lb. for pease; and 60 lb. for rye and maize. As maize is a crop which, it is generally believed, could not be successfully grown in this country, the imports of this grain are converted into barley on the basis of their respective feeding values per unit of weight of grain as determined in the Rothamsted Experiments:—

—	Bushels	Average yield per acre in the United Kingdom	Acres
Barley . . .	26,757,000	33·65, say 34	= 787,000
Oats . . .	42,546,000	39·98, „ 40	= 1,064,000
Beans . . .	4,837,000	27·13, „ 27	= 179,000
Peas . . .	3,446,000	26·04, „ 26	= 133,000
Rye . . .	1,860,000	„ 30	= 62,000
Maize in equivalent of barley }	94,230,000	33·65, „ 34	= 2,771,000
Hay . . .	cwt. 2,870,000	cwt. 30	95,000
			5,091,000

To economise the land that would be required for the production of the imported oil-cake the several varieties of cake may be converted into their feeding equivalent of linseed, which, among cattle foods, possesses the largest feeding value per unit of weight: that is to say, to produce a given weight of meat, a smaller weight of linseed is required than of any other feeding-stuff. For these conversions recourse has again been had to the valuation tables of Sir John Lawes and Sir Henry Gilbert.

The oil-cake converted into linseed in this way works out as follows:—

—	—	Equivalent if fed as linseed	Yield of linseed per acre	Acres
	cwt.	bush.	bush.	
Linseed cake . .	6,807,000	= 11,765,000	20	= 588,000
Cotton-seed cake . .	5,264,000	= 7,799,000	20	= 390,000
Rape " "	353,000	= 366,000	20	= 18,000
Other oil-seed cake, principally rape }	120,000	= 124,000	20	= 6,000
—	—	—	—	1,002,000

Of fodder grains, hay, and oil-cakes the imports therefore afford the following results in terms of acres :—

Imported grains and hay . . . .	acres 5,091,000
„ oil-seed cakes . . . .	1,002,000
	<u>6,093,000</u>

Thus, on the basis of the average yields per unit of area in this country, our annual importation of the principal kinds of feeding-stuffs represents at least the produce of about six million acres. But to complete this aspect of the question of our food supply we have yet to estimate what productive area is represented by the imports of wheat, meat, and dairy products. Potatoes may be excluded, as the imports are so small.

The net annual importation of wheat in 1894-98 amounted to 179,368,000 bushels, and this quantity would be the produce of 5,979,000 acres at the estimated average yield of the United Kingdom (30 bushels per acre).

For meat and milk the calculations are not so simple. The average annual net importations of beef, mutton, and pork, and of milk in all forms (except margarine and fresh milk and cream) in the five years were as follows :—

Beef and veal . . . . .	tons 339,000
Mutton and lamb . . . . .	170,000
Pig-meat . . . . .	335,000
Milk in all forms . . . . .	gallons 1,160,675,000

It will, perhaps, be prudent not to include the item of pig-meat, because if we could grow in this country the whole of the imported feeding-stuffs referred to above, as well as the imported milk, there would be a considerable amount of offal and waste material derived from the manipulation of these articles which might be converted into pork. It is not likely that the amount of pork produced in this way would be at all

equivalent to the quantity imported annually, but it is so difficult to determine satisfactorily the value of such offal and waste as food for swine that, to avoid any exaggeration, it seems advisable to exclude imported pig-meat from this estimate.

The question is then, what area would be required to furnish the imported beef, mutton, and milk? Let us take a moderate view of the situation and inquire what area would be necessary under the best conditions. On this point a number of well-known agriculturists and other authorities have been consulted. The question put to them was what extent of land of the best quality on a mixed farm would be required to produce annually 1,200 lb. of beef, 112 lb. of mutton, and 500 gallons of milk respectively? From the answers furnished to this inquiry and from other sources of information the following estimates have been derived of the extent of land requisite in each case:—

1,200 lb. of beef	.	.	.	.	acres
112 lb. of mutton	:	:	:	:	6.5
500 gallons of milk	.	.	.	.	0.64
	.	.	.	.	2.0

According to these standards, the imports of beef, mutton and milk respectively represent the produce of the undermentioned areas:—

Beef	.	.	.	tons	acres
	.	.	.	339,000	4,108,000
Mutton	.	.	.	170,000	2,176,000
	.	.	.	gallons	
Milk	.	.	.	1,160,875,000	4,643,000
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					10,927,000
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The figures relating to wheat, feeding-stuffs, meat, and milk may now be brought together. Expressed in terms of acres, our imports of these commodities furnish the following results:—

Wheat	.	.	.	.	.	acres
	.	.	.	.	.	5,979,000
Beef	.	.	.	.	.	4,108,000
Mutton	.	.	.	.	.	2,176,000
Milk	.	.	.	.	.	4,643,000
Feeding-stuffs, mainly for conversion	.	.	.	.	.	
into meat and milk	.	.	.	.	.	6,093,000
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						22,999,000
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Now this estimate of 22,999,000, or in round numbers 23,000,000 acres, is a moderate one. On the average yields obtained from the soil, good and indifferent alike, of this country, the extent of land required to produce our present

annual imports of the articles of food with which we have been dealing would undoubtedly be larger than the acreage shown above. The full significance of the figures is better appreciated when it is remembered that the total area of land and water in the United Kingdom is 77,671,000 acres, and that the acreage under crops and grass is about 47,800,000 acres. Thus, it is obvious that we could not add to our productive surface anything approaching the area represented by the imports of wheat, meat and milk. There remains, of course, the possibility that our dependence upon imported supplies of food might be lessened by again bringing under the plough land formerly arable and now occupied by grass. But, while an extension of the grass area at the expense of the arable may entail a loss of productive power, it must not be forgotten that the less fertile land is generally the first from which the plough is withdrawn, and it scarcely needs demonstration that whatever may be that loss in this country, its recovery would carry us but a short way on the road towards 23,000,000 acres.

Some writers, however, seem to think that the extent of available land need not be considered: that by making radical changes both in our methods of farming and in our social organisation, the productivity of the soil of this country might be increased sufficiently to enable us to feed ourselves. But advocates of such reforms as "thorough cultivation" or "one man one potato patch," or "universal spade husbandry," usually ignore the existence of the law of diminishing returns. Every bushel yielded beyond a certain limit has involved a larger and less profitable expenditure of labour and capital, and this may be continued until the margin is on the wrong side. Ideal yields and cheap food are incompatible. Hence, to the farmer as a man of business and not as an idealist it is not a question of what he could produce by labour of love, but of what it will pay him to produce.

But whatever view may be held as to the shortcomings of British agriculture, there is abundant evidence that it is, on the whole, more productive than that of any other country, in spite of any advantages that may be supposed to exist in foreign systems of farming or of land tenure. It is true that Belgium is sometimes held up for our emulation as an example of a country which, owing to the more perfect cultivation of its soil, is able to meet the food requirements of a population exceeding in density that of the United Kingdom; but an examination of the productive capacities of Belgian agriculture does not support this view. Besides, the agriculture of Belgium is not exposed to the full force of foreign competition,

inasmuch as duties are imposed on meat and dairy products, though all cereals, except oats and flour, are free. But it is to the credit of British husbandry that without the aid of protection it is able to show a greater return from the land than is secured even by the highly protected agriculture of such countries as France and Germany.

That there is no foundation for the view that Belgium is able to nearly feed her people from her own soil may be seen from the following statement showing the percentages of her average annual requirements of cereals and potatoes derived from the home products and from external sources in the period 1894-98. Similar figures are shown for the United Kingdom for purposes of comparison :—

	Belgium		United Kingdom	
	From home production	From imports	From home production	From imports
Wheat . . .	26	74	23	77
Rye . . .	95	5	50	50
Barley . . .	26	74	56	44
Oats, buckwheat, and maize }	61	39	46	54
Potatoes . .	100	—	97	3

There are few estimates of the Belgian consumption of meat to which any great faith can be attached. According to one authority whose figures correspond closely with what might be expected from the number of live-stock kept in the country, and from the statistics of meat imports, the average quantity of meat of all kinds consumed annually is about 70 lb. per head, of which 11½ lb. or 16 per cent. is imported and 84 per cent. home produce. For the United Kingdom it will be remembered that the percentages in the same order are 34 and 66 respectively. Satisfactory estimates of the Belgian production of milk are not available.<sup>1</sup> It is clear, however, from the above figures that Belgium does not nearly feed her people from her own soil.

Germany, on the other hand, still continues with the aid of heavy fiscal duties to produce at home the larger portion of the food consumed within her borders. Nevertheless German agriculture is generally less productive than that of the United Kingdom, the average yields of the principal cereals being from 20 to 25 per cent. below those obtained in this country.

<sup>1</sup> Since the above was written, I have received, through the kindness of M. de Vuyst, a number of estimates by experts of the milk yields of Belgian cows. These would give an average net yield per cow of over 500 gallons.

It is doubtful, too, whether the present position of Germany in respect of food supply can be much longer maintained under existing conditions; the demands of her growing urban communities for cheap food must naturally tend to accelerate that movement towards increased importation of cereals which is already evident in the trade statistics of the Empire, though it may be temporarily checked by additional fiscal restrictions.

France, too, with an almost stationary population, has not yet found the demand for food on the part of her people exceed the home resources, supported by a scheme of protection which it is sometimes sought to justify by the fact that agriculture still forms the chief pursuit of nearly half the occupied population of the country, and by reference to international considerations—the latter may also be an element exercising some influence on the attitude of Germany towards this question of self-maintenance. In spite, however, of greater artificial support, or perhaps as one result of it, French agriculture is even less productive than that of Germany, the average yields obtained per acre of the principal cereals being from 30 to 40 per cent. below those to which we are accustomed.

The relative positions of the several countries to which reference has been made may be summarised in a few comparative statements showing the supplies of food per head of the respective populations, and the proportions contributed from the home production and from imports. For bread grains, meat, milk, and potatoes, the results are as follows:—

	Bread grains								
	Wheat			Spelt			Rye		
	Home produce	Imports	Total	Home produce	Imports	Total	Home produce	Imports	Total
United Kingdom	lb. 82	lb. 273	lb. 355	lb. —	lb. —	lb. —	lb. 3	lb. 3	lb. 6
Belgium . .	113	324	437	15	—	15	155	9	164
Germany . .	110	45	155	11	—	11	250	34	284
France . .	413	50	463	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>	66	1	67

	Meat			Milk			Potatoes		
	Home produce	Imports	Total	Home produce	Imports	Total	Home produce	Imports	Total
	lb.	lb.	lb.	gals.	gals.	gals.	lb.	lb.	lb.
United Kingdom	79	48	127	36	29	65	282	9	291
Belgium . .	62½	7½	70	—	5½	—	799	—	799
Germany . .	95	4	99	58½	¾	59	1,016	2	1,018
France . .	76½	3½	80	41	—	41	568	—	568

<sup>1</sup> Included with wheat.

It would appear from this table that the average dietary of an inhabitant of the United Kingdom contains a much larger quantity of meat than that of a Belgian, Frenchman, or German, but a smaller proportion of bread and potatoes. In Belgium more bread and less meat are consumed than in any of the other countries named, while in France a noteworthy feature is the apparently small consumption of milk. In the case of potatoes the considerable requirements in Belgium and Germany are largely accounted for by their use in the manufacture of spirits and starch.

No account has been taken of grosser forms of animal food, of which there is a small consumption abroad, and possibly also in this country. For example, the French official estimates take notice of the meat of the horse, mule, and ass; some of the returns of the municipal abattoirs in Germany also deal with horses and donkeys slaughtered for human food; in Belgium, too, such meats are eaten, and even in our own country a demand for horseflesh for human food is recognised by an Act passed in 1889, in which the expression "horseflesh" is defined as including the flesh of asses and mules. Hippophagy, however, is not extensively practised in any of these countries, probably least of all in the United Kingdom, where perhaps it is confined to destitute foreign immigrants. In most cases it is no doubt a taste acquired of necessity.

In connection with these estimates of the consumption of meat and milk, it has already been pointed out that figures purporting to show the home supplies of such articles are misleading, unless due allowance is made for the imported materials utilised in the rearing of the live stock concerned. And, moreover, such estimates are from their nature generally of a less precise character than those relating to grain, which are, in most cases, based on inquiries repeated at short intervals. But meat and milk are, after all, merely transformed vegetable food, and a better conception of the real extent to which each country contributes to its own food supply would be obtained from a comparison of the estimates of production of cereals and other vegetable feeding-stuffs, so far as these are recorded. There would, however, be some difficulty in thus ascertaining the human consumption of these products, because a portion of some of the articles is also utilised in feeding urban horses and in manufactures. Still the quantities consumed in these directions are for human requirements, and in an emergency the whole would be available for food. So that a country's contribution of vegetable food-stuffs to its requirements of such materials for all purposes is a fair indication of the extent of

its ability to feed its people. From this point of view a comparison of the capacities of the countries named above, with respect to their production of cereals, would furnish the following results.<sup>1</sup> The grains included in each case are wheat, barley, oats, rye, beans, peas, maize, buckwheat and mixed corn:—

—	Total production of all grains	Requirements per head of the population for consumption in all forms	Number of people whose requirements are met by home produce	Number per cent. of total population
	Mils. of lb.	lb.	No.	
United Kingdom	13,623	884	15,410,000	39
Belgium . .	3,150	1,022	3,181,000	49
Germany . .	38,023	895½	42,460,000	80
France . .	83,020	945	34,941,000	91

So far we have been dealing with the number of persons deriving their supplies of grain from the home agriculture. A further calculation shows the area of land utilised for the production of such supplies for a given number of inhabitants to be as follows:—

—	Number of persons supplied by home agriculture	Number of acres utilised in producing such supplies	Number of acres utilised for 1,000 persons
United Kingdom .	15,410,000	8,934,000	580
Belgium . . .	3,181,000	2,086,000.	656
Germany . . .	42,460,000	36,939,000	870
France . . .	34,941,000	36,112,000	1,034

In examining this statement it must not be overlooked that the requirements per head are larger in Belgium, France, and Germany than in this country. Consequently, to ascertain the productive capacities of the agriculture of each country, it would be necessary to assume that the supplies required per inhabitant were equal in all cases. Taken on the basis of our own requirements, viz., 884 lb. per head all round, the acreage employed in supplying the wants of 1,000 persons would work out as follows:—

<sup>1</sup> Potatoes, roots, and other green stuffs utilised in the production of meat and milk need not be considered, because of these products each nation apparently produces sufficient for its needs, though there is a small importation of potatoes into the United Kingdom and Germany. Of oil-cake we import 41 lb.; Belgium, 31 lb.; Germany, 17 lb.; and France, 4 lb. per head.

	Number of inhabitants supplied at 884 lb. per head	Number of acres utilised in producing these supplies	Acres per 1,000 persons
United Kingdom . . . . .	15,410,000	8,984,000	580
Belgium . . . . .	3,563,000	2,086,000	585
Germany . . . . .	43,013,000	36,989,000	859
France . . . . .	37,853,000	36,112,000	967

The above figures again bring out the fact that, judged from the standpoint of productivity, the system of farming in this country is, if anything, superior to that of Belgium, and far ahead of those of France and Germany. This result is of interest, inasmuch as it meets, to some extent, the argument that a redistribution of the land of Great Britain into smaller holdings, such as exist abroad, would be conducive to the better cultivation of the soil. A further rejoinder is, of course, that the present distribution of the agricultural land of this country into relatively large holdings is evidently that which farmers find most profitable under economic and social conditions differing greatly from those of continental communities. These are considerations that may also be borne in mind when we are told that a system of farming which maintains under the plough less than 50 per cent. of the cultivated area of the United Kingdom is, necessarily, less profitable, and more wasteful, than that prevailing in Belgium, which has 78 per cent. of ploughed land, or of those of France and Germany, which retain as arable more than 75 per cent. of their cultivated surface.

The point just discussed, as to the relative merits of the respective systems of farming, has been further elaborated in an interesting article by Mr. Hooker dealing with the area cultivated, and the amount produced, by each person returned as occupied in agriculture in the several countries named above, and in Holland.<sup>1</sup> In this article it is shown that the English farmer, in spite of having much more land under permanent grass, has just as much land under the plough as the Frenchman, nearly one-third more than the German, and almost double as much as the Belgian; while, as regards the area under corn and pulse, he is beaten apparently only by the Frenchman. The explanation of this somewhat unexpected fact is to be found in the very much larger area worked by each agriculturist in this country than on the Continent.

As regards the amount produced per worker, it is shown that of cereals each English agriculturist produces from 60 to 80 per cent. more than the Frenchman or Belgian, and more

<sup>1</sup> *Journal of the Royal Statistical Society*, vol. lxii. part iv., 1899.

than twice as much as the German. And even of bread-corn, wheat and rye, we raise as much per cultivator as Belgium and Germany, though probably less than France. But the advantage of England is seen most prominently in roots, the production being 20 tons, as against  $9\frac{1}{2}$  in Belgium, only 3 in France, and  $2\frac{1}{2}$  in Germany; while of hay the English production per agriculturist is apparently twice as much as the Belgian, the French and German yields being insignificant. The superiority of the Englishman is stated to lie almost entirely in his additional production of fodder-crops, including roots and hay, and this is confirmed by reference to the larger number of live stock maintained per agriculturist in this country. Indeed, the advantage lies, in Mr. Hooker's opinion, wholly with this country, for, while we devote much more land to grass, "we do so in addition to producing as much of the direct requirements of human beings by the same amount of labour."

In conclusion it may be observed that the object of this review has been to throw some light on the real position of the United Kingdom, and incidentally of some of her neighbours, in respect of the important question of the maintenance of the food supplies of the population. Some of the estimates noticed, especially those relating to the consumption of meat and milk in their finished forms, are only approximative; on the other hand, the results based on the estimates of the production and imports of grain and other food-stuffs used, directly and indirectly, for human food approach more closely to the facts. So far as this country is concerned, it seems to be clear that our dependence on external sources of supply is represented by a volume of food-stuffs which could not, under conditions known to our experience, be economically produced in this country. It might be lessened in some degree if it should be possible in the future to increase the productivity of the soil, but it has been shown that the adoption of foreign methods would not afford any assistance in this direction. The advance of scientific research may in some quarters be held to foreshadow prospects of further improvement. Meanwhile, however, each step onwards is bounded by the law of diminishing returns, and population grows.

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## THE CONSTRUCTION OF A MODERN BACON FACTORY.

THE modern bacon-curing factory differs altogether from what used to be known as the "curing cellars." These curing cellars, of which our modern bacon-curing factories are the successors, were conceived in many, perhaps in most, cases with very little regard to the laws of physics. The important parts which light, heat, and air play in the curing of meats were hardly taken into account. Time was indeed when heavily salted meats were appreciated by the public, but the demand for these has almost disappeared. In a few country districts, farmers still produce hard-cured blocks of what is by courtesy known as "bacon," but which tastes of nothing but salt, and produces a well-nigh unquenchable thirst in those who partake of it. This hard-cured meat can be "cured" in almost any kind of place, any outhouse or house cellar that is handy. The meat is simply covered up with salt and left to lie until it has become fully charged with it throughout. The product, however, is not bacon.

Bacon, as the term is now understood, consists of the sides of pigs, or portions of them, treated in such a way as to render them capable of being kept for a greater or less time as desired.<sup>1</sup> The porky flavour of the fresh meat has disappeared and a totally different flavour has taken its place, due to a change in the tissues of the meat assisted by the process of "curing." The flavour has just sufficient salt about it to make its presence felt, but this is altogether subservient to the flavour of the meat.

Primitive methods have now practically disappeared, and given place to others which have for their end the production of mild-cured bacon, and it is proposed to show here in what kind of structure this can best be done.

### SWEDISH AND DANISH FACTORIES.

There are factories of varying dimensions spread all over Europe, notably in Sweden and Denmark. In Sweden the

<sup>1</sup> See *Bacon Curing*. By London M. Douglas. Journal R.A.S.E., 3rd series, vol. ix. (part i.), 1898, pp. 68-103.

government of the country is largely in the hands of the agriculturists, and by a modern series of protective laws directed against imported feeding stuffs they have literally killed out the industry of bacon curing in that country. It is currently reported that during the present year most of the Swedish bacon-curing establishments will be compelled to close.

In Denmark there are forty-one factories, and they are, with

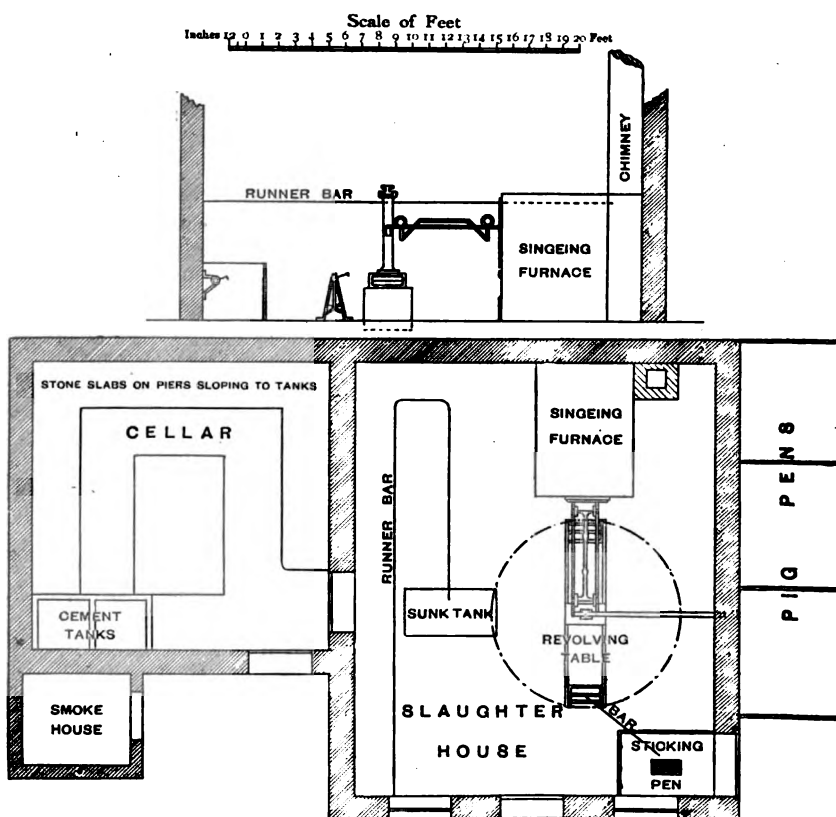


FIG. 1.—Ground plan and section through slaughter house of bacon factory capable of working up 50 pigs per week.

one or two insignificant exceptions, equipped with modern machinery and mechanical appliances. Cheapness in construction is what is aimed at in many of these factories. The cellar and engine-room are usually substantially built places, but the other departments are constructed of cheap material, such as corrugated iron or plain matchboarding. A factory to handle,

say. 200 pigs per week, and constructed in this way, would cost about 3,000*l.* complete. Such a sum is not great, and is well within the compass of many British farmers' clubs.

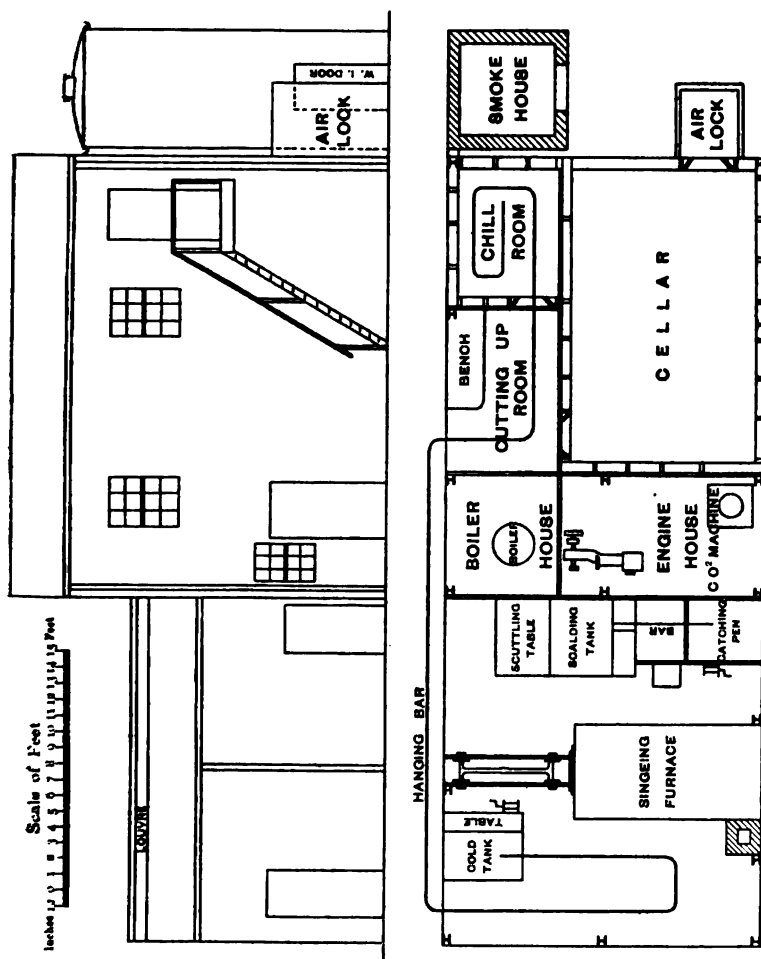


Fig. 2. - Ground plan and front elevation of bacon factory for 50 pigs per week.

### SMALL BACON FACTORIES.

In many of the remote districts, where farmers carry on large dairy farms, it becomes essential to feed a great number of pigs, so as to use up the separated milk. As it is often impossible to dispose of the live pigs to advantage, a small bacon factory becomes then a necessity. In figs. 1 and 2 are shown

details of two different factories. These have the advantages of being simple and costing comparatively little to build. A further development of the same idea is illustrated in fig. 3,

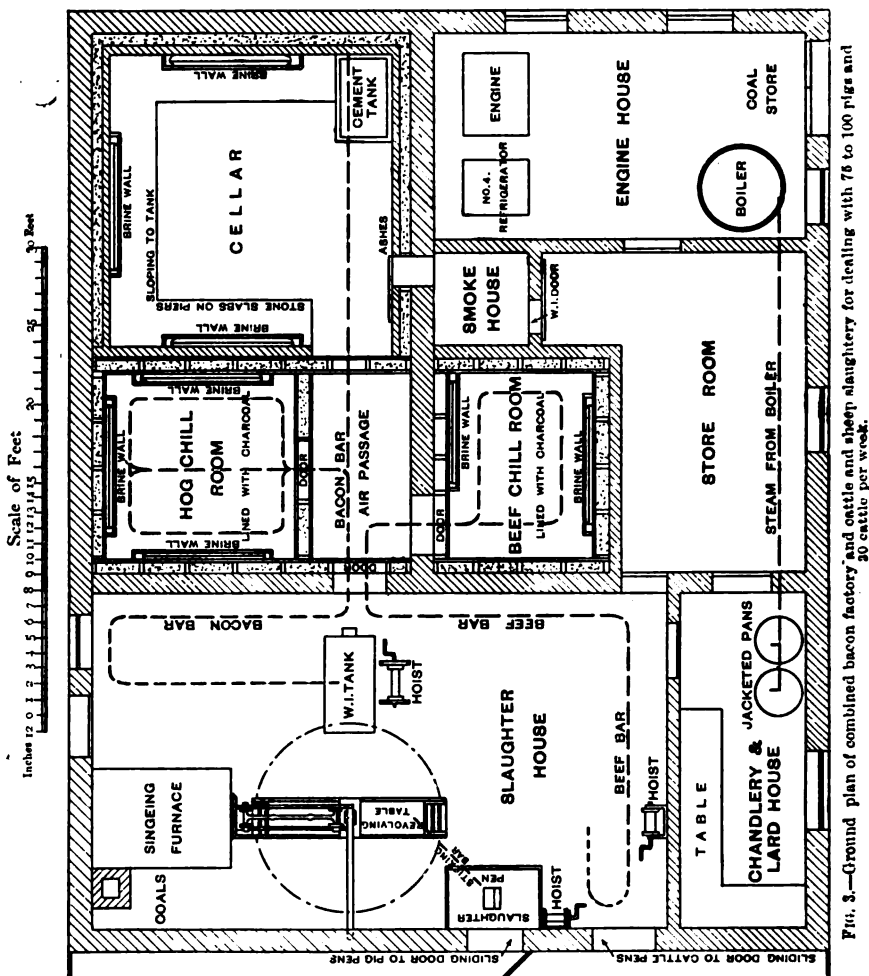


FIG. 3.—Ground plan of combined bacon factory and cattle and sheep slaughterery for dealing with 75 to 100 pigs and 30 cattle per week.

which shows how the business of slaughtering cattle is carried on in conjunction with bacon curing. Such a combination is suitable for a large estate or district where there are available, say, 75 to 100 pigs and 30 head of cattle per week.

## MODERN LARGE BACON FACTORIES.

The design of a bacon factory must always depend upon local conditions. Preferably a site should be selected where there are plenty of space and abundance of water, and where there are few dwelling-houses. Such ideal conditions are not always attainable, however. In Ireland especially the bacon factories are right in the heart of the busiest thoroughfares. This has certain advantages. The offal is generally more easily disposed of, and the local trade gets better attention. Such a factory has recently been built and equipped for Messrs. Kehoe, Donnelly, & Pakenham, Ltd. It is right in the heart of the city of Dublin, and represents the best features of a modern Irish factory. The capacity is 500 to 1,000 pigs per week. The approximate value of buildings, mechanical equipment, and land is 10,000*l*. A large department is laid out for pig-styes, with a capacity of 300 pigs at one time. This factory is not designed primarily for Wiltshire bacon curing, but is principally for hams. The house to whom the factory belongs is celebrated in Paris and other markets for the quality of its "York" hams, and consigns very large quantities to Paris. This is a highly lucrative business, for if the middles and other parts of the pigs are well sold, or if indeed they can be sold at the same rate at which they were bought, the average price will show a handsome profit.

As far as possible the departments are arranged in sequence so as to obviate undue handling. The pigs are slaughtered, dressed, and pushed along the bars into the hanging house, whence they pass into the chill rooms and then into the "cutting-up room." From this latter place the various sections are distributed to their several departments. The auxiliary departments are completely equipped with the varied machinery for lard-making, sausage-making, &c. In one respect this factory will take the lead of all others in the United Kingdom, inasmuch as there is to be installed an apparatus for dealing with the refuse, blood, &c., in an economical manner. The apparatus will be that of Baron Podewils, so well known in connection with various continental factories. By its means fallen or diseased pigs, together with any other animal residues in the factory, can be disposed of at once and converted into a dry-powder manure. Should there be any fat present, this is separated mechanically and commands a good price for soap-making.

Perhaps one of the finest modern factories is that of the Yorkshire Bacon Curing Co., Ltd., Selby, Yorks, the ground

plan of which is shown in fig. 4, and from which a good many of our illustrations are taken.

This factory owes its existence to the enterprise of the farmers in the West Riding of York, the Selby Farmers' Club, the Earl of Londesborough, and his energetic agent, Mr. H. L. Chowan. These gentlemen appreciated the high economic value of pigs to the farmer, and recognised that there was really no bacon factory in Yorkshire, notwithstanding the world-wide reputation of "York" hams, the mere name of which is a kind of goodwill.

The factory is situated in an ideal situation in the outskirts of the old-fashioned town of Selby, a town which lies in the centre of a vast populated area. A field close to the railway was acquired, and the factory designed and built there. The total cost, including land, buildings, and mechanical equipment (most of which is in duplicate), was about 15,000*l*. This figure is large because of the substantial character of the buildings provided, and because of the duplicating of the various mechanical appliances.

The various departments of a modern factory are the following:—

- |                                                                               |                                                      |
|-------------------------------------------------------------------------------|------------------------------------------------------|
| 1. Pig-styes.                                                                 | 10. Packing room to smoke stoves.                    |
| 2. Slaughtering and dressing house.                                           | 11. Steam drying room for pale dried bacon and hams. |
| 3. Skin or offal house.                                                       | 12. Sawdust store.                                   |
| 4. Hanging room.                                                              | 13. Pork-pie room.                                   |
| 5. Chill rooms.                                                               | 14. Lard room and lard stores.                       |
| 6. Cellars with salt store.                                                   | 15. Sausage room and packing department.             |
| 7. Packing room for green bacon.                                              | 16. Boiler and engine rooms.                         |
| 8. Drying room for maturing hams and bacon (on the first floor over cellars). | 17. Offices.                                         |
| 9. Smoke stoves for smoking sides and hams, chaps, &c.                        | 18. Stables.                                         |

All of these departments involve considerable detail in construction, as will be seen from the illustrations which follow.

Brick is the material used in the construction of the Selby factory, whilst the floors are in some places laid with blue chequered tiles and in others with a bed of 6-inch concrete, trowelled and finished with cement. The heights vary throughout according to the department.

### 1. *Pig-styes.*

The general idea is that the operations should follow each other in such sequence as to avoid too much handling, hence the pig-styes lead up to the slaughtering pen. The accom-





modation is for 500 pigs at one time, and the styes being divided up and numbered can thus accommodate pigs from different farmers or consigners. The division walls require to be very strong, as otherwise the continual fighting of the pigs amongst themselves would soon lead to destruction. These divisions are built of brick with stanchions at intervals, and are finished off with a coping, binding all together.

## *2. Slaughtering and Dressing House.*

Sticking pen.—This forms part of the slaughtering "tack," as it is called (fig. 5). It is lined with white glazed bricks, and the walls are very high, the whole slaughtering department being 15 feet to the wall plate. The equipment consists of a track bar and power winch. This winch is connected up to shafting from the main engine, and is so arranged that by pulling a rope, and thus making frictional contact, the rope ascends or descends at will. The pigs to be slaughtered are caught by means of a chain passed through a ring and forming a noose. This is slipped over one of the hind legs and the pig is hoisted on to the overhead bar and despatched instantly. The process of slaughter consists of sticking the suspended pig (hanging head downwards) in the neck quickly with a sharp knife, and pushing the latter right home in the direction of the heart, where it severs the aorta or large blood vessel, and the blood flows out in a few seconds. The whole operation, if not very pretty, is at least expeditious, the actual time involved between catching the animal and pushing it along the bar into the bleeding passage being about 10 seconds. Immediately the pigs are slaughtered they are thrust along the overhead bar into the bleeding passage, where they are allowed to hang for a few minutes. They are then pushed forward and allowed to drop on the dumping table, where the leg chains are removed. They are promptly pushed into the scalding vat and turned round in the water there. This scalding vat is a rectangular tank about 8 ft. long by 5 ft wide by 2 ft. 6 in. deep, and is fitted with a cradle or lever attachment by which the pigs can be caught and thrown out of the scalding tank on to the scuttling table. This table is formed out of heavy sparring, and is connected up to the scalding tank, occupying the space between the scalding tank and the singeing furnace. The pigs, having been scalded (in water at 140° for fine-skinned pigs and at 150° Fahr. for coarse) until the hair comes away in the hand easily, are thrown by means of the cradle from the scalding tank on to the scuttling

table, and there they are scraped with bell scrapers until fairly clean. Above the scuttling table is arranged a series of small cold-water sprinklers, which are allowed to play upon the

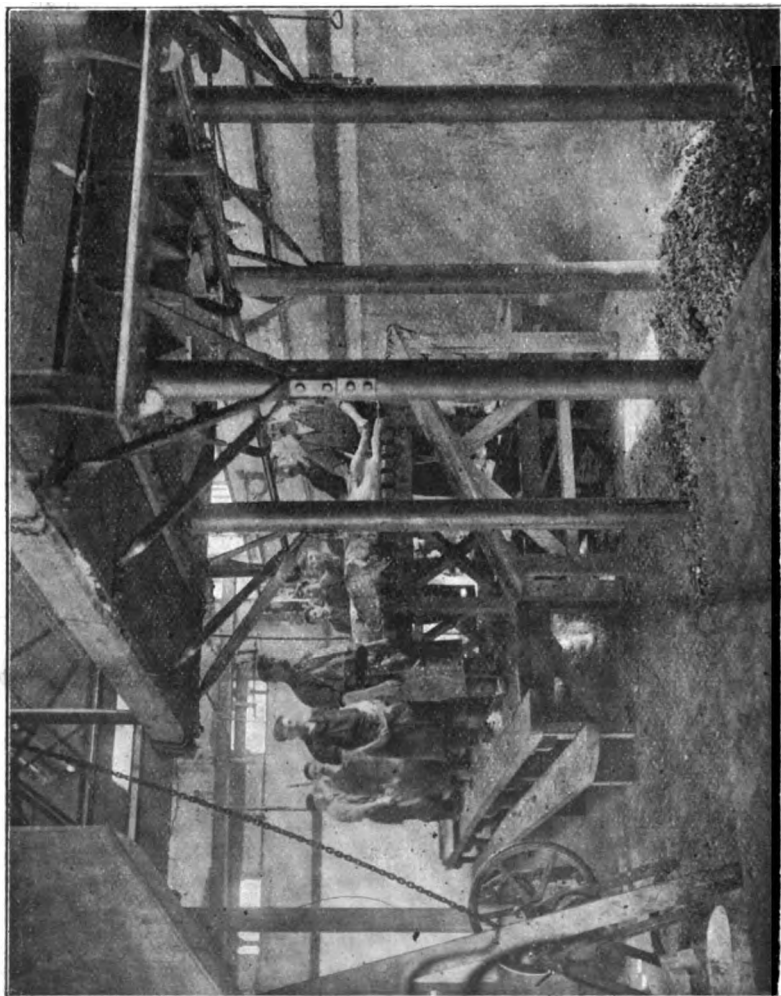


FIG. 5.—Slaughtering "tack," showing gang of men at the scuttling table scraping the pigs, which are afterwards placed on the bar, and are then drawn up through the furnace and singed. The singeing furnace is shown in front.

warm carcasses while the scraping is proceeding. The carcasses are then singed on the singeing stack, which is perhaps the most important of the appliances in the slaughtering department. It consists of a vertical stack built very strongly

of fire bricks bound heavily together, and all raised on the top of four columns by means of a platform. The flue in the centre is circular and of just sufficient diameter to allow of the free passage of pigs up and down. At the bottom of the flue is a fire enclosed by means of a circular grid. From the top is hung a heavy chain which hangs straight down the centre of the grid, and which is lowered up and down by means of a windlass.

In the operation of singeing, a gob-hook is inserted in the lower jaws of the pigs and one lug of these double-lugged hooks is placed on a bar which travels under the flue of the furnace. The pigs are pushed down an oblique board from the scuttling table, and are then suspended by the gob-hook. They are pushed forward until they come under the flue of the singer, and immediately the free lug of the gob-hook is caught up by the singer chain, the windlass is set in motion, and the pigs one by one are raised through the fire. This has to be done expeditiously so as not to destroy the skin of the pigs. The pigs are lowered again on to the bar, and immediately dropped into a bath of cold water, in which the gob-hooks are withdrawn, the toe-nails removed, and the sinews of the hind legs exposed so that a gambrel can be inserted, and the pig again suspended from the track bars.

The singeing furnace is capable of dealing with four pigs per minute in the manner described. The pigs are raised, by means of the gambrel inserted beneath the sinews of the hind legs and a bar-hook, on to the disembowelling bar. Here they are first scraped with flat large-bladed scrapers, the while cold water is at will allowed to flow over them from overhead sprinklers.

They are then disembowelled and the intestines are taken to the skin house. The leaf lard, with kidney in, is left to be weighed along with the pig, as are the head and feet. But the pig is weighed without the intestines, the result being known as "dead-weight." The average weight of good bacon pigs is from 190 to 200 lb. live weight: the "dead-weight" is just 25 per cent. less on the average.

### *3. Skin or Offal House.*

This is where the intestines are separated out and cleansed. The "plucks" (heart, liver, and lungs) are not, however, dealt with here, being sold separately. The stomachs with the intestines are thoroughly well cleansed, and the stomachs are sold by themselves after being cooked, or they are sold to

makers of pepsin. The intestines are either cooked and sold as "chitterlings," or they are prepared as skins for sausage makers.

#### 4. *Hanging Room.*

The primary object of the hanging room is to permit the surplus animal heat to escape from the carcasses before they are placed in the chill rooms. Here also the carcasses (dead-weight) are weighed. As soon as the weighing has taken place the pigs are cut into sides, the head and feet and the vertebral column being removed. The blade bone is also drawn clean out (the opening so made is ultimately known as the "pocket," and is a very easily tainted part of a side of bacon). The sides, having been trimmed, are pushed along the "return" bar of the hanging house and into the chill rooms.

#### 5. *Chill Rooms.*

These are constructed with a view to removing the animal heat as quickly as possible. We have seen that the excess of heat is reduced by hanging the whole carcasses in the hanging house. Now we want to reduce the temperature of the sides to 40° Fahr., as at this temperature the tendency to putrefactive change is reduced to a minimum, and on the other hand it is the lowest temperature at which the meat will "take" the salt satisfactorily. The only way in which this can be done perfectly is by means of mechanical refrigeration.<sup>1</sup> Refrigeration, indeed, is the one absolutely indispensable feature in a modern bacon factory. The refrigerator itself forms part of the equipment of the engine-room (fig. 6), but the accessories as applied to the chill rooms are of interest here.

It has been found in actual practice that damp air in the chill rooms usually means taint or slime with the bacon. Hence the design of the accessories for extracting the heat or for producing "cold" (manifestly a wrong description, but a very common one) is first of all to extract or condense the moisture, and secondly to maintain constant dryness for from twelve to eighteen hours at a temperature of 40° Fahr.

The means of doing this are simple enough. A "cooler" is provided in which cold brine is circulated. This brine is deprived of its heat in the evaporator of the refrigerating machinery, and is circulated by means of pumps through the "cooler."

<sup>1</sup> See *Cold Storage: its Principles, Practices, and Possibilities*. By Dan. Pidgeon, Assoc.Inst.C.E. Journal R.A.S.E., 3rd series, vol. vii. (part iv.), 1896, pp. 601-617.

The "cooler" consists of, say, 500 feet run of  $1\frac{1}{4}$  in. piping, arranged in a perfectly insulated space so that air drawn from the chill rooms by means of a fan is circulated over the entire area

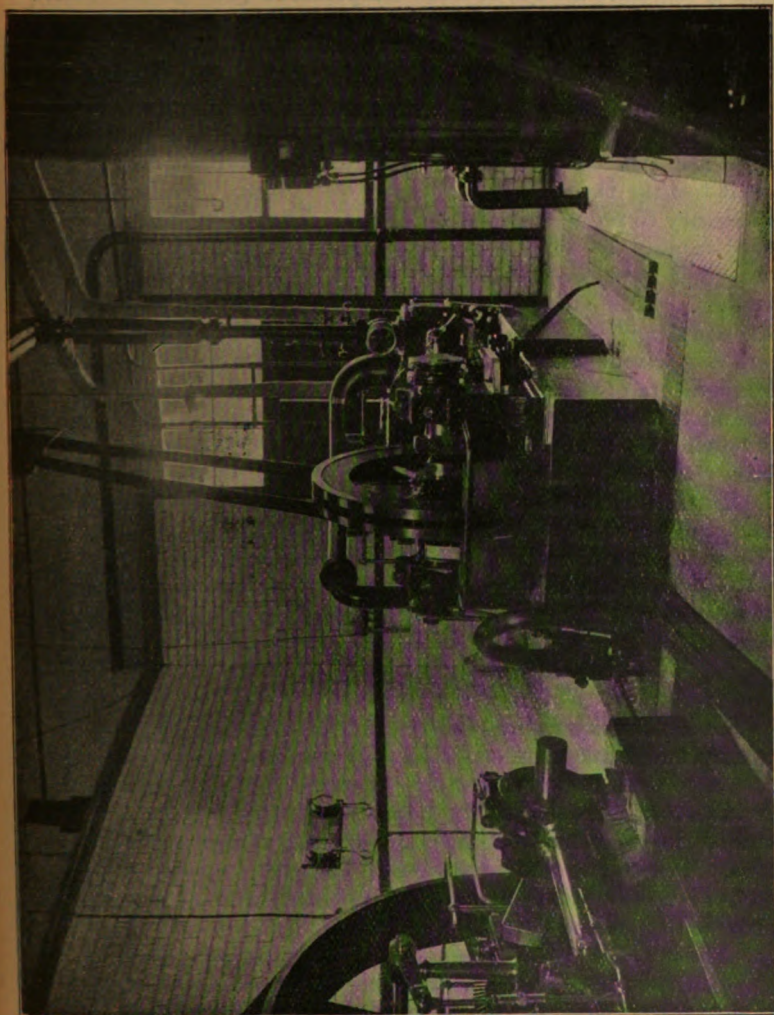


FIG. 6.—Engine-room, showing portion of main driving-engine of factory on the left. In the centre is a No. 10 duplex carbonic anhydride refrigerating machine.

of the piping, after which it is again discharged back into the chill room. But it is no longer charged with moisture, nor is it of the same temperature, for the moisture has been arrested by the cold surfaces of the pipes, and remains in the form of snow,

whilst part of the heat present in the air has been absorbed by the brine. This brine is being constantly pumped backwards and forwards through the evaporator of the refrigerating machine, and is therefore always at a low temperature ( $10^{\circ}$  to  $15^{\circ}$  Fahr.).

In addition to the "cooler," however, it is necessary to have a storage of "cold," or, in other and more proper language, to have a surface of cold that will absorb heat when the cooler is not working. This is in consequence of the length of time it takes to extract the total heat from the pigs. At first, when they are put in the chill rooms, they probably register on meat-testing thermometers  $75^{\circ}$  to  $80^{\circ}$  Fahr. It is therefore necessary to reduce this to  $40^{\circ}$  Fahr. The "cooler" does this very rapidly by circulating the air, but the last few degrees may not have been extracted when it is time to close the factory. The storage of brine referred to then continues the work, and if the chill rooms be kept closed overnight without any circulation of air, but with a storage of brine, the temperature of the sides will be found reduced in the morning. The method of storing this brine in the chill rooms is by means of "brine walls" or brine cylinders, 4 in. cast-iron pipes, or 8 in. brine "drums." These are invariably placed along the ceiling.

The chill rooms should be fitted with track bars upon which to hang the sides of bacon, and these bars should be at least 7 ft. 6 in. in the clear from the chill-room floors.

Of course the chill rooms should be efficiently insulated so that there will be no loss of "cold," or gain of heat from outside.

#### 6. *The Cellars with Salt Store.*

The cellars are usually built with hollow side walls, insulated ceiling, and insulated floor. The ceiling is insulated with silicate cotton packed between the joists, and the floor is insulated by laying down, first 12 in. of coke breeze, then 2 in. of pitch, and 3 in. of concrete, finishing off with flagstones or blue tiles. The cellars should always be sloped in one direction, so as to give the pickle which forms a proper fall. Catch-alls are provided to collect the pickle.

The cooling of the cellars is by means of brine pipes only, as the atmosphere rarely needs to be disturbed there, and dampness is what is wanted. When the atmosphere becomes vitiated, it can be passed over the cooler and returned again fresh to the cellars. But curing cannot be successfully conducted where there is a current of air constantly travelling.

The salt store should be adjacent to the cellars, so that the temperature of the salt may be uniform with the temperature of

the cellar itself. The pickle also used for pumping should be stored in the cellar, so as to preserve the same uniformity of temperature throughout.

#### *7. Packing Room for Green Bacon.*

This consists simply of an open covered space, at the door of the cellars, in which bales of bacon are made up for despatch.

#### *8. Drying Room for Maturing Hams and Bacon.*

This department is needed in some factories for keeping hams and bacon until they are "mature"—that is, until they develop a thick coating of fungus due to decay! The trade for this kind of meat is very limited, except in the North of England, where Cumberland bacon and York hams of the "matured" type have a ready sale.

#### *9. Smoke Stoves.*

These are essential in all modern factories, as the demand for smoked meats is very extensive. To construct an efficient smoke stove is considered rather difficult. The most successful are those of dimensions about 11 ft. by 12 ft. on ground plan, and rising in three stories with automatic louvres on the top. The first tier is formed of bars and a platform is laid across these. This platform opens from the smoke stove packing loft. At a height of 7 ft. over is another series of bars, and again at 6 ft. above that is a third series. "Gilled" steam pipes are laid all round the walls under the first tier of bars, so that the heat ascends. In the walls are placed thermometers which have the bulbs inside the stoves and the scales on the packing loft, so that the inside temperature can be quickly and easily read. This temperature should not exceed 85° Fahr.

The manipulation of even a perfectly constructed stove is a matter requiring considerable skill and experience, and previous knowledge is always desirable. Some accessories of the smoke stoves are shown in figs. 7 and 8.

#### *10. Packing Room.*

The packing room in front of the smoke stoves is, as its name implies, the necessary complement of the stoves themselves. Here the hams, bacon in sides, middles, rolls, chops, and all the other products sent out in a smoked condition, are packed for delivery.

### 11. *Steam Drying Room.*

This department is for those goods required to be delivered in the "pale-dried" or unsmoked state. It is simply a room

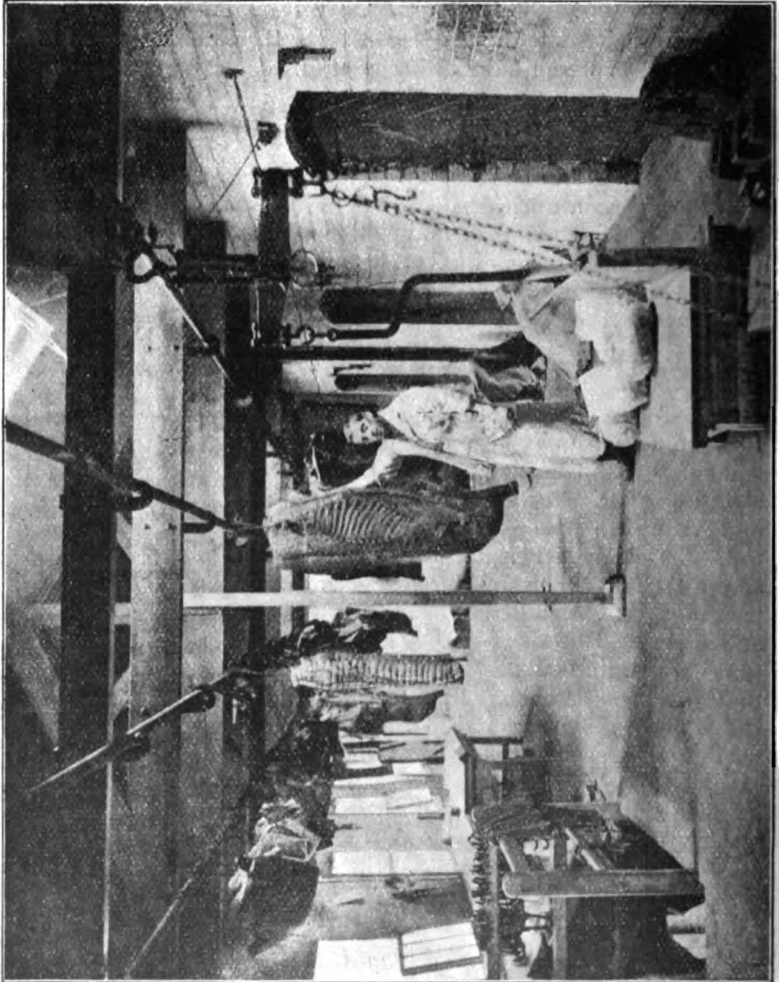


FIG. 17.—Smoke-house loft. The smoked bacon is selected, weighed, and bled here.

fitted up with hanging bars suspended from the roof tie-beams, whilst a line of gilled steam pipes is laid on the floor round the four sides. These latter give the heat required. The temperature should not exceed 85° Fahr.

### 12. *The Sawdust Store.*

The oak or hardwood sawdust used in smoking the bacon is stored here. As oak sawdust is only obtainable at certain times of the year, a store becomes a necessity.

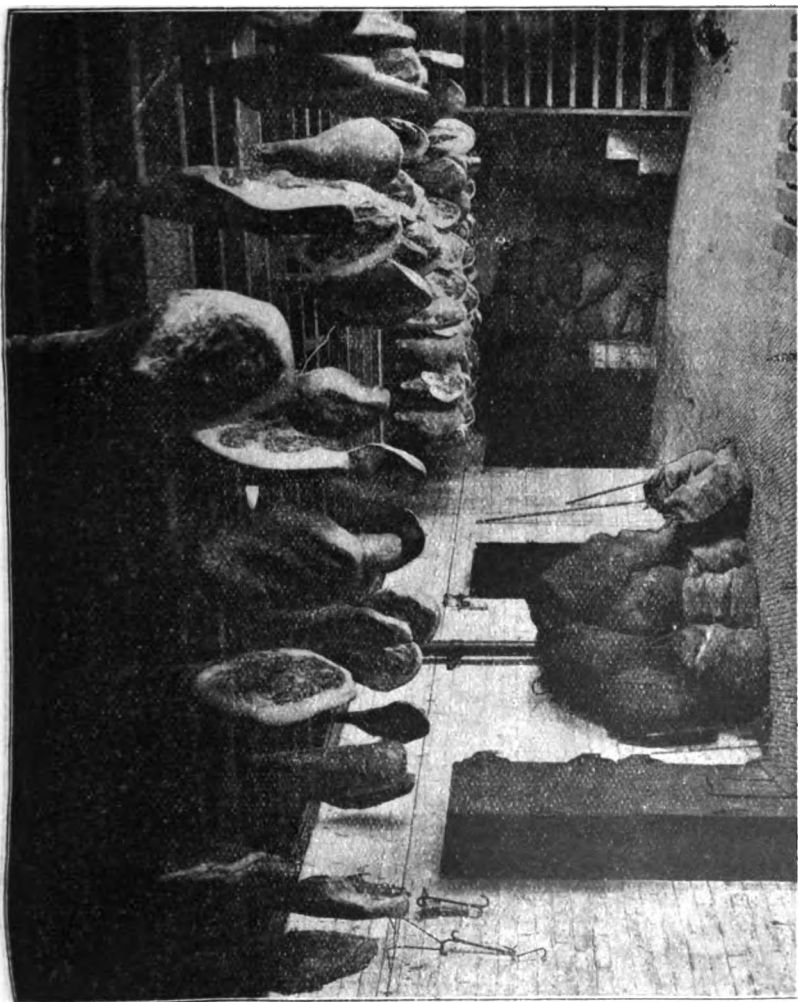


FIG. 8.—Basement of smoke-house loft (also used for ham-drying), showing the iron entrance doors to the smoke houses.

### 13. *Pork-Pie Room.*

This is one of the important auxiliary departments, inasmuch as it is highly remunerative. Pork pies are consumed in great

quantities in England, and their sale seems to extend every day. The necessary equipment of a pie department are: oven, pie machine, set of pie moulds, flour vats, warm-water pan, cooling racks. With the same equipment bread can be baked as well.

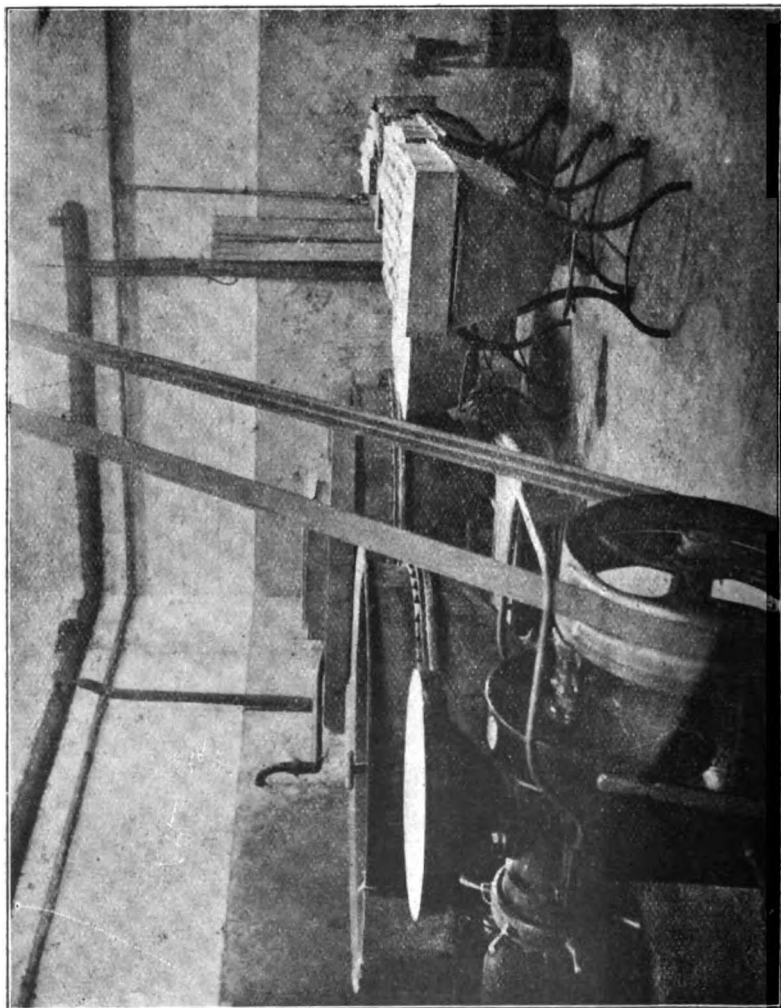
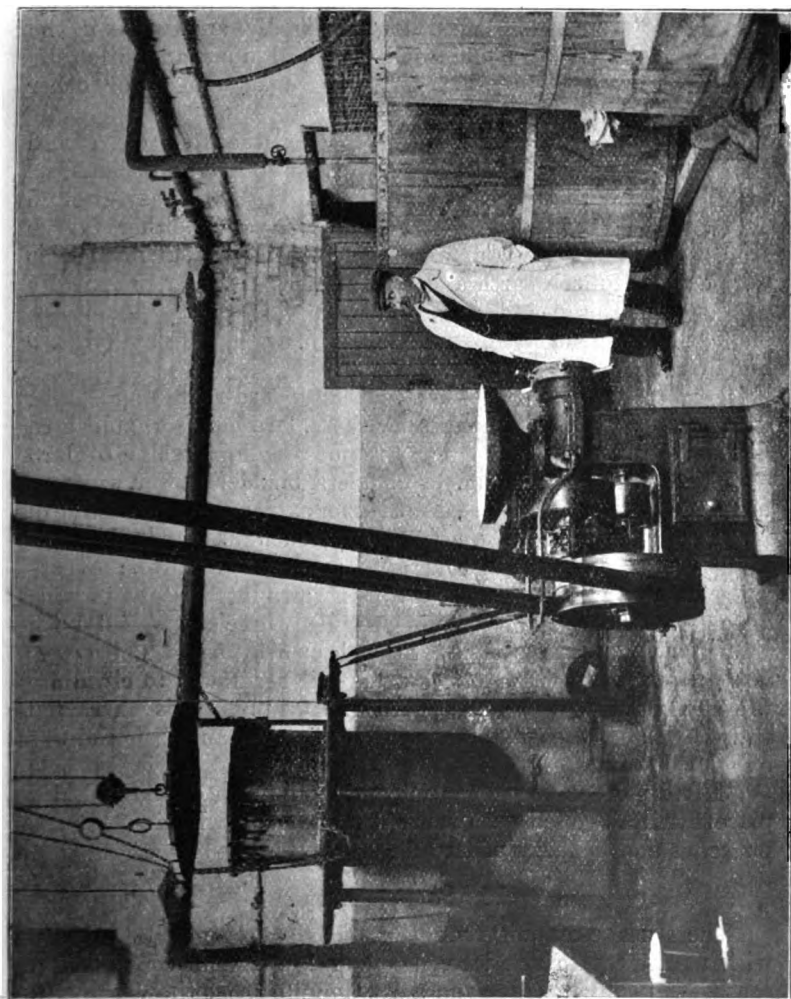


FIG. 8.—Lard room, showing in front the fat and lard outter, and in the left corner the two large pans used for melting the lard and other fat in.

#### 14. *Lard Room and Lard Stores.*

Lard is one of the products in a bacon factory which are invariably sold at a loss—that is to say, it is always sold for

less than its original cost in the pigs. Nevertheless, much time and money are expended in trying to produce good lard. The "flick" lard or kidney fat is always superior to the other fat



Mudgeon vat

Lard and fat cutter

Bone digester

Fig. 10.—Lard room, with various appliances.

of the pig, and therefore fetches a much higher price. It is kept separate from all the other fat converted into lard.

The process is as follows: the fat is cut, by means of an "Alexander" cutter, into squares of about  $\frac{3}{4}$  in. in size, and

these are thrown into a jacketed pan where a temperature of about 200° Fahr. is maintained. From this pan the lard is either run by means of gravitation, or is ladled, into an adjoining pan where it is "refined." Both these operations are accompanied by constant agitation. The melted fat is then pumped into an "Agitator," where it is cooled down gradually, and, while in the semi-cold state, is drawn into a cold lard filler, and filled by means of pressure into bladders, square parchment or other packages.

The object of the agitator is to mix the free olein and stearin homogeneously together. Lard oil is not, so far, extracted in European factories, although this is an easy enough thing to do by means of hydraulic presses. Neither is the manipulation of neutral lard much developed. The refining also by means of fuller's earth and filter presses is so far practically unknown in Europe.

The equipment necessary in an ordinary lard room (figs. 9 and 10), as we know it, is as follows:—

Lard cutter, two 15-cwt. capacity lard-rendering pans, strainer, skimmers and stirrers for these, lard agitator, cold lard filler, set of lard moulds, lard press for pressing residue of lard from greaves, cooling tank for bladders, bladder blower, and two mudgeon vats. These last are used for extracting the residue of fat from all the refuse of the factory, such as gut-lard, trimmings, refuse from sausage factory, ham trimmings, &c.; everything in fact that contains fat can be thrown into these vats with advantage. The mudgeon vats are filled three parts full with water, and the various residues are thrown into it. The water is then boiled by means of a steam coil perforated to circulate the steam through the lard, when the fat present is extracted and floats on the top of the water, and can be skimmed off after settling.

A lard store is very essential, and should be a clean, cool, dry place, fitted all round with sparred racks, upon which to lay the packages and bladders of lard for stock.

### 15. *Sausage Room.*

The sausage-making room (fig. 11) should be well equipped with machinery in duplicate. The essential plant consists of a sausage-mincing machine and a sausage filler, but these two will not suffice for a large trade.

The following may be put down as necessary:—

Two silent sausage machines,	One spice mill,
Two vertical hand fillers,	One canning vat,
One vertical power filler,	Three jacketed boiling pans,
One square fat and brawn cutter,	One iron smoke oven.

There should also be a lock-up seasoning department, fitted with a series of bins for storing the various requisites for sausage-making. The sausage room should be lofty and have plenty of light and air.

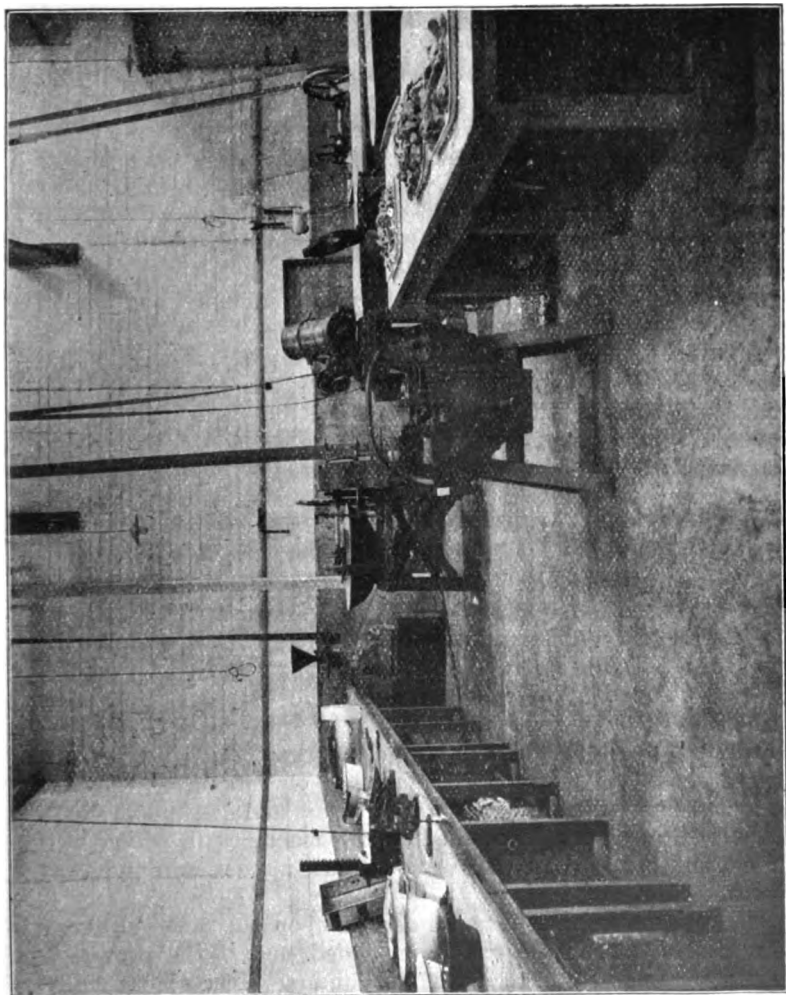


FIG. 11.—Sausage-making Room.

#### 16. *Boiler and Engine Rooms.*

The boiler should be in duplicate, so that in case of a breakdown no stoppage need take place.

The engine room, as the place from which power is transmitted throughout the factory, should always be designed to allow plenty of space. The height necessary to wall plate is about 20 ft. The contents are :—

1. The main driving engine,
2. The refrigerating machine,
3. The dynamo.

1. The main driving engine can be of almost any type. The horizontal slow-speed engine, non-condensing, is generally adopted. There are, however, very many types to choose from.

2. The refrigerating machine is the most expensive part of the equipment of a modern factory and the most essential.

There are many makers of refrigerating machinery, but only two refrigerants are recognised in England, viz. ammonia and carbonic anhydride (carbonic acid or carbon dioxide). There are other expansive gases used on the Continent, but not in England.

Of the comparative merits of the two gases, ammonia and carbonic anhydride, there are many opinions. Ammonia is an irritating poison and is difficult to control. As valves and glands will not last for ever, there are bound to be escapes occasionally. It is at such times that the greatest danger is to be apprehended. There is another difficulty. It has not been found possible to devise a perfect safety-valve for ammonia machines. Hence there is always the danger present of accident through the carelessness of workmen. Explosions have not been infrequent in these countries, and have unhappily been attended with terrible results. Where, therefore, ammonia is used much care must be exercised in the working.

Carbonic anhydride or carbonic acid is used to a very great extent as a refrigerant, and with great success. It has in its favour the fact that it is a heavy gas which falls to the ground, and so minimises the danger of suffocation if there should be an escape. It is quite odourless and does not irritate. A safety-valve can be applied to the machines in which it is used, and hence the risk of explosion is altogether done away with.

Refrigerating machines all depend upon the same principle for their action, viz : a gas is expanded, and in the process of expansion absorbs heat from surrounding objects ; this heat becomes "latent." In the process of compression this latent heat is again given off. These effects are taken advantage of in a refrigerating machine by forming a cylinder round the evaporator, or part of the machine in which the gas is evaporated, and running through this cylinder an unfreezable brine, from which

the evaporator extracts a certain amount of heat. The brine is circulated either through the "cooler" described above, or brine cylinders, or brine walls, and in its turn takes up heat in its progress, being again returned to the evaporator, and the heat it has taken up is again extracted, and so on. Meantime the evaporated gas containing the latent heat is passed into a condenser in which the action is exactly the reverse of the evaporator. The gas is compressed (inside coils similar to those of the evaporator) and the latent heat is given off. Water is poured over the coils and absorbs the heat so given off, and this water is run into the drain. The gas is liquefied as it parts with its "latent" heat, and in the liquid state is returned to the evaporator again, so making the cycle complete.

In the engine room shown on fig. 6 (p. 45) there is a duplex carbonic anhydride refrigerating machine, to which are attached four large cylinders, two of which are the evaporators and the other two the condensers. The machine is driven by a powerful condensing steam engine, and there are two compressors. Hence the necessity for two evaporators and two condensers. From the evaporators is circulated by means of centrifugal pumps the cooled brine of the evaporators. This brine is unfreezable at ordinary low temperatures, being made from calcium chloride and water.

The brine is pumped through the "cooler" previously described and also through brine walls in the chill rooms. It is pumped through 4-in. cast-iron pipes at 12-in. centres in the cellar. Thus this great volume of brine is constantly absorbing heat from the chill rooms and cellars, and as it returns to the evaporators it again loses the heat it has taken up on its journey. This is the principle upon which all modern chill rooms and cellars are cooled.

3. A dynamo is a very necessary part of the equipment of a bacon factory, inasmuch as it is essential to have the coolest kind of light in the chill rooms and cellars.

### 17. *Offices.*

The offices of a factory are very much according to the individual taste of the owners. There should always be a private room for the manager, a public office for the staff, and a timekeeper's office.

### 18. *Stables.*

It may be found necessary to keep horses, but this will altogether depend upon local conditions.

## GENERAL CONSIDERATIONS.

The foregoing description will enable the reader to form an idea as to the construction of a modern bacon factory. It will be noted that factories can be so designed as to meet local conditions. In rural districts, where it may be considered a feasible plan to cure bacon on the spot, a company of agriculturists or others can therefore, without any great risk, try the experiment. Should it be successful, it is an easy matter to enlarge such premises as may have been put down.

In the United Kingdom there is plenty of room for bacon factories, if economically constructed and worked with intelligence. England is the great dumping-ground for the bacon of the world.

Dairy farmers are recognising that the pig is an important item on the farm, in view of the fact, referred to at the outset, that it can be fed to a large extent on separated milk. During recent years butter-making has made great strides everywhere in the United Kingdom, and the consequent production of separated milk has been large. Seeing, therefore, that we have recognised that butter-making is a remunerative industry, it ought to follow in natural sequence that bacon-curing, on a more extended scale than at present, will be similarly recognised.

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## EXPERIMENTS—AT ROTHAMSTED ON THE CHANGES IN THE COMPOSITION OF MANGELS DURING STORAGE.

NOTWITHSTANDING that mangels are almost invariably stored for at least two months before being given to cattle, and that most of the roots are consumed after being kept a good deal longer—sometimes even for two years—we have no direct evidence to show whether, after the first few weeks, the roots deteriorate or improve, or, if they improve in quality, whether the benefit is not neutralised by an actual loss of substance. A ton of roots after twelve or eighteen months' storage might be of greater value than a ton of the same crop two months after the roots were pulled, but until we know how much the roots have lost in weight during the longer period, and in what the loss consists, it is hardly possible to say whether the prolonged keeping has resulted in an actual gain or not.

In absence of any very definite information respecting the changes which take place in mangels we will briefly consider such results as are available which have been obtained with other root crops.

In 1876 the late Dr. Voelcker<sup>1</sup> determined various constituents in Swedish turnips, both at the time of taking up, and, subsequently, at different dates, in similar roots which had been stored in the usual manner. Analyses were also made of roots which had been left in the ground, and of roots which were stored without being topped. We will, however, confine our attention to the roots stored after removal of the leaves. The following table gives the percentage composition at the time they were pulled (November 30), and at two subsequent periods (March 12 and April 25):—

*Percentage Composition of Swedish Turnips.*

—	Water	Nitrogen	Sugar	Pectin sub- stances	Fibre	Ash
In roots when taken up	89·10	0·214	3·87	0·71	4·37	0·45
"    March 12	90·84	0·159	4·04	0·67	3·01	0·45
"    April 25	90·90	0·124	2·56	0·75	4·46	0·56

<sup>1</sup> Journal R.A.S.E., 2nd series, vol. xiii. part ii. 1877, p. 164.

The results show a great loss of nitrogen and sugar, the loss of sugar being the larger. The initial weights of the stored roots are not recorded, otherwise the actual losses would probably be found to be slightly greater still, while the apparent gains in pectin substances and fibre on April 25 would no doubt be eliminated. It should be added that the determinations were made each time with three or two roots.

In the case of sugar-beet, Pagnoul showed<sup>1</sup> that cut roots lost almost all their sugar, by fermentation, in 126 days (November–March). Whole roots stored from April to June lost 25 per cent. of the crystallisable sugar by slow combustion.

The results next to be discussed have a more direct bearing on the subject of this paper. In 1859, Voelcker<sup>2</sup> had occasion to examine a mangel-wurzel which had been kept for two years. The root had not intentionally been reserved, and the original weight was consequently unknown, and no data were available as to the original composition of the crop. The results present, however, some points of interest:—

*Percentage Composition of a Mangel kept for Two Years.*

—	Water	Nitrogen	Sugar, pectin, &c.	Cellulose	Ash
In root . . .	92.25	0.18	4.08	1.18	1.36
In dry matter .	—	2.32	52.67	15.22	17.64

As pointed out by Voelcker at the time, the percentage of water is unusually high, especially when it is considered that there is generally a loss of water during storage. This high percentage is attributed to loss of organic matter as gas; and the fact that the total nitrogen is also high would seem to indicate that the loss was mainly due to destruction of carbohydrates, although there might, of course, also be a breaking up of proteids without elimination of nitrogen. The very high percentage of ash also lends support to this view, but inasmuch as about half of it consisted of sodium chloride, the abnormal amount of ash was no doubt partly due to the application of much salt as manure.

We have, therefore, in the case of Swedish turnips and sugar-beet, direct evidence of very considerable changes in composition when the roots are stored, while in the case of the mangel just referred to there is strong reason to believe that it had undergone a good deal of alteration.

<sup>1</sup> A. Pagnoul, "Ueber d. Zersetzung von aufbewahrten Rüben," *Contr.-Blatt f. Agrikultur-Chem.* vol. xx. (1891), pp. 771–773.

<sup>2</sup> Journal R.A.S.E., vol. xx. part i. 1859, p. 131.

In the experiments now to be described attention was directed mainly to the changes in the amount, and also in the nature, of the sugar, as the most important constituent of mangels. The sugar was determined by polariscope, and the cupric-reducing power, before and after inversion, by the method described by Brown and Morris.<sup>1</sup> The amounts of ash and total nitrogen,<sup>2</sup> and in some cases the pentosans,<sup>3</sup> were also determined.

The samples of roots were obtained from two plots of the permanent Root-crop Field (Barnfield), Plot 2 of Series I. (14 tons dung, 450 lb. basic slag, and 500 lb. sulphate of potash per acre), and Plot 2 of Series II. (same manures with 550 lb. nitrate of soda in addition). The selected roots, which in each case were as similar as possible in weight and form, were topped, cleaned, and each one separately weighed and numbered. They were then put into a cool place—a brick shed built over a well and covered by a deep tank—where they were kept the whole time covered with straw. For the small number of roots (20 from each plot) reserved for these preliminary experiments this method of storing seemed preferable to keeping them in the clamp. At suitable intervals roots were taken from the heap, again weighed, and samples for analysis taken by means of a segment-grater.

It will be convenient to consider the results obtained with the roots from the two plots separately.

*Series I. Plot 2.*—Of the twenty roots reserved, several had become soft, or were more or less decomposed—generally very slightly—by the end of June, and for want of material the

<sup>1</sup> *Trans. Chem. Soc.* vol. lxxi. 1897, p. 278.

<sup>2</sup> The question of the changes in the nitrogenous constituents of mangels has recently been investigated by T. B. Wood, *Journal R.A.S.E.*, 3rd series, vol. ix. part iii. 1898, p. 555.

<sup>3</sup> Determined by the phloroglucinol method (M. Krüger, Inaug. Diss. Göttingen, 1895). It may be explained that pentosans (xylan, of which wood-gum mainly consists, and araban) are carbohydrates of the formula  $(C_5H_8O_4)_n$  which, when heated with dilute acid, take up the elements of water, yielding pentoses (or pentaglucooses),  $C_5H_{10}O_5$ . The change is analogous to the conversion of starch (hexan) into glucose. It may be added that pentosans are very widely distributed in plants; in cereal straw, for instance, about one-fourth of the dry matter consists of pentosans. They are also prominent constituents of hay (especially gramineous), brewers' grains, bran, &c. A characteristic property of pentosans, which is utilised in their determination, is that they are quantitatively converted into furfuraldehyde (from *furfur*, bran) by prolonged heating with dilute acid, pentoses being formed as intermediate products.

W. E. Stone (*Proc. 7th Ann. Conv. Assoc. Official Agric. Chemists*, Washington 1890) has determined pentosans in a number of foods (compare also Tollens, *J. Landw.* vol. 40, p. 11; Flint and Tollens, *Ber. deut. Chem. Ges.* 1892, vol. 25, p. 2912; and de Chalmont, *Exper. Stat. Record*, vol. 6, p. 693).

experiment could not be continued after that time. Only roots which were perfectly sound in every part were of course utilised.

In the following table are given the percentage loss of weight of the roots, and the percentages of the different constituents, calculated on the original weights of the roots when pulled (October 20, 1898):—

*Barnfield Mangels, Series I. Plot 2.*

1898-99	No. of roots	Average original weight of roots, Oct. 20	Total loss per cent.	Per cent. in original weight of roots					
				Dry matter	Sugar		Pentosans	Nitrogen	Crude ash
					Total	Invert			
		lb. oz.							
October 31 . . .	2	2 11·8	4·07	14·73	9·67	0·21	1·13	0·185	0·94
January 6 . . .	3	2 13·2	5·76	13·43	9·19	0·92	—	0·168	0·91
March 28 . . .	3	2 12·2	7·22	14·24	9·80	0·69	—	0·156	0·87
June 20 . . .		2 12·5	11·03	12·01	8·30	4·29	0·82	0·190	1·14

Owing no doubt to variations in the composition of the individual roots, and to the small number available, the results, which are consistent at the different dates (as, for instance, the relatively high sugar, and the lower nitrogen, on March 28), show irregularities taking each constituent at the different periods. No essential change (except in total weight, evidently due to loss of water) took place up to the end of March. During the next three months, however, there was a considerable loss of dry matter, much of which was due to destruction of sugar, whilst about half of the cane-sugar was inverted.

The changes in the composition of the dry matter of the roots, and the percentage losses of organic matter, sugar and pentosans, were as follows:—

1898-99	Per cent. in dry matter					Per cent. loss of each constituent			
	Organic matter	Sugar	Pentosans	Nitrogen	Ash	Dry matter	Organic matter	Sugar	Pentosans
October 31 . . .	93·62	65·65	7·65	1·256	6·38	—	—	—	—
January 6 . . .	93·24	68·43	—	1·248	6·76	8·82	9·21	4·96	—
March 28 . . .	93·83	68·82	—	1·094	6·17	3·33	3·00	+1·3	—
June 20 . . .	90·55	69·01	7·84	1·579	9·45	18·47	21·17	14·17	27·4

The increase in the percentage of sugar in the dry matter indicates that the loss was greatest in the non-sugar; nevertheless by June 20 about 14 per cent. of the sugar had disappeared.

The results obtained with the roots from Series II. Plot 2, which we will next describe, show greater regularity; and they

differ in some respects from those obtained with the roots of Series I. Plot 2.

*Series II. Plot 2.*—As already mentioned, this plot receives, like Plot 2 of Series I., dung (14 tons), basic slag (450 lb.) and sulphate of potash (500 lb.), but with 550 lb. of nitrate of soda in addition.

As regards the number of sound roots from the two plots, after storage, Plot 2 of Series II. was somewhat less satisfactory than Plot 2 of Series I. In the case of the nitrate plot there were no soft roots by the end of June, but more of the roots were partially decayed.

The results are as follows :—

*Barnfield Mangels, Series II. Plot 2.*

1898-99	No. of roots	Average original weight of roots, Oct. 20	Total loss per cent.	Per cent. in original weight of roots					
				Dry matter	Sugar		Pentosans	Nitrogen	Crude ash
					Total	Invert			
		lb. oz.							
October 31 . . .	2	3 4.0	2.65	13.04	8.22	0.37	0.97	0.215	1.04
January 6 . . .	3	3 4.3	5.71	12.49	7.53	0.54	—	0.250	1.07
March 28 . . .	3	3 5.0	8.39	11.13	6.87	2.06	—	0.224	1.05
June 20 . . .	1	3 5.8	7.08	10.95	6.53	2.18	0.72	0.207	1.12
July 4 . . .	1	2 13.4	35.18	11.03	6.63	3.78	—	0.227	0.95

We have here a regular decrease both of dry matter and of sugar. Even by the end of March the loss of sugar was considerable, and a good deal was inverted.

The single root, analysed on July 4, was, like the rest, quite sound, but owing to its much smaller size, and to the fact that it was very much shrivelled, it was not sampled along with the root taken out in June. Apart from the great loss of water, the changes undergone by this root are, however, quite similar to the rest.

The changes in the amounts of the different constituents, and the percentage loss of each, were as follows :—

1898-99	Per cent. in dry matter					Per cent. loss of each constituent			
	Organic matter	Sugar	Pentosans	Nitrogen	Ash	Dry matter	Organic matter	Sugar	Pentosans
October 31 . . .	92.01	63.04	7.46	1.652	7.99	—	—	—	—
January 6 . . .	91.40	60.29	—	1.999	8.60	4.22	4.75	8.40	—
March 28 . . .	90.48	61.72	—	2.010	9.52	14.64	16.00	16.42	—
June 20 . . .	89.81	59.64	7.24	1.890	10.19	16.03	19.08	20.56	25.8
July 4 . . .	91.36	60.11	—	2.056	8.64	15.41	16.00	19.34	—

In these roots, manured with nitrate, in addition to dung and minerals, there is a tendency for the percentage of sugar in the dry matter to diminish, and not to increase as in the case of Plot 2 of Series I. (without nitrate). The loss of sugar was much greater, and the loss of non-sugar less, under the influence of nitrate, than without nitrate. There is no evidence to show which of the substances other than sugar have diminished in quantity, but there is obviously a difference in the character of the changes which took place in the roots of the two plots.

Calculating the constituents of the two sets of roots as percentages in the organic matter, the following numbers are obtained:—

*Constituents per Cent. in the Organic Matter of Mangels.*

1898-99	Series I. Plot 2 (no nitrate)				Series II. Plot 2 (nitrate)			
	Non-sugar	Sugar	Pentose	Nitrogen	Non-sugar	Sugar	Pentose	Nitrogen
October 31 . . .	29.88	70.12	8.18	1.354	33.49	66.51	8.11	1.795
June 20 . . .	23.79	76.21	8.66	1.744	33.59	66.41	8.06	2.104

Let us now consider the actual loss of sugar from the produce of an acre, which is, after all, the important point. Of course the results given only include a few conditions of experiments, and it is to be borne in mind that the actual amount of loss will vary very much, according to the soil, the manuring, and the season, and the consequent condition of the roots as to ripening and other characters when taken up and clamped. But, as an illustration of the amount of loss that may take place, the following shows what the loss would be reckoned per acre according to the actual results obtained in the above experiments, on the roots from Plot 2, Series I., and Plot 2, Series II. The yields per acre of roots in 1898 from the two plots were:—

	tons	cwt.
Series I. Plot 2 . . . . .	18	17
Series II. Plot 2 . . . . .	28	7

The amounts of sugar in October and June in the roots from an acre were as follows:—

	Oct. 31, 1898		June 20, 1899		Loss
	tons	cwt.	tons	cwt.	cwt.
Series I. Plot 2 . . . . .	1	16.5	1	11.3	5.2
Series II. Plot 2 . . . . .	2	6.6	1	17.0	9.6

There was, therefore, a very great loss of sugar, especially in the case of the nitrate plot; and it must be remembered that

there was also a destruction of other constituents—greater in Series I. than in Series II.—the value of which we have at present no means of estimating. It is obvious that, according to the varying conditions above referred to, there may be in some cases much less, and in others even more, loss than the examples quoted show.

As regards pentosans, which do not hitherto seem to have been determined in mangel-wurzels, their value as food is still undecided. We have evidence that some animals digest pentosans more or less, but it is doubtful to what extent the digested substances are assimilated.<sup>1</sup>

It is of interest to note that the changes in the amounts of pentosans in the stored roots follow those which take place in the hexacarbhydrates; and that the initial amounts in the roots manured with, and without, addition of nitrate also follow those of sugar, being less in the roots of the nitrate plot. This is in accordance with De Chalmont's statement,<sup>2</sup> that the percentage of pentosans in plants diminishes as the nitrogenous constituents increase. Stoklasa,<sup>3</sup> on the other hand, states that while large amounts of nitrate lower the percentage of sugar (in beet), the percentage of pentosans is increased.

Taking into account the variety of conditions which presumably affect the changes undergone by stored roots, any conclusions drawn from the results can only be given with some reserve. It seems, however, very probable that a considerable loss of the most important constituent, sugar, and of other constituents, does frequently take place. That nitrate of soda increased the loss of sugar, if not of other constituents, seems to be highly probable, since the two lots of roots were kept together under exactly the same conditions.

The inversion of sugar cannot be said to be of any practical importance in the case of mangels, and the extent of the inversion is no indication of the amount of sugar lost.

Whilst a certain amount of loss would seem to be unavoidable when mangels are kept for the usual period of some months, the question arises whether it is desirable, and likely to be remunerative, to greatly prolong the storage, as is sometimes recommended. Increased digestibility after a lengthened period is conceivable, and might be due to a partial breaking

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<sup>1</sup> W. E. Stone and W. J. Jones, *Ann. Rep. Maine State Coll.* 1893, p. 44; J. B. Lindsey and E. B. Holland, *Ann. Rep. Agric. Exper. Stat. Amherst, Mass.* 1894; Goetze and Pfeiffer, *Landw.-Versuchs-Stat.* 1896, vol. 47, p. 59; and Weiske, *Exper. Stat. Record*, vol. 7, p. 336.

<sup>2</sup> *Berichte d. deut. Chem. Ges.*, vol. xxvii. (1894), p. 2722.

<sup>3</sup> *Chem. Centr.* 1899, I. 890.

down o the crude fibre, similar to that which, according to Holdefleiss<sup>1</sup> takes place in the production of hay from grass. In view, however, of the small amount of crude fibre in roots a change of this kind would seem to be of doubtful value; and any gain in digestibility, if it takes place, may be a good deal more than counterbalanced by the losses to which we have called attention.

This season much larger numbers of roots have been reserved, and as they have been clamped in the usual manner, it will be possible to ascertain whether the conditions of storing influence the keeping qualities of the roots.

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Harpenden.

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<sup>1</sup> *Mitteil. d. Landw. Inst. d. kgl. Univ. Breslau*, Heft 1, 1899.

## Official Reports.

### REPORT OF THE SPECIAL COMMITTEE ON THE SOCIETY'S SHOW SYSTEM.

*[For a report of the discussion in Council on the recommendations of this Committee, see pages xxxv to xlviii of the Appendix.]*

1. The Special Committee appointed by the Council on July 26, 1899, "to consider and report as to any modifications or alterations in the present show system of the Society which they may consider desirable after the present rotation is completed" (in 1902), have carefully investigated the subject referred to them, and have agreed upon the following Report.

2. The Committee, as originally constituted, was to consist of the Chairmen of the several Permanent Committees concerned in the administration of the Shows, viz. : Sir Nigel Kingscote (Finance), the Hon. Cecil Parker (Veterinary), Mr. G. H. Sanday (Stock Prizes), Mr. W. Frankish (Implement), Sir Jacob Wilson (Show-yard Works), and Mr. Marshall Dugdale (Dairy), with Mr. Percy Crutchley (Honorary Director) and three unofficial members of the Council to be nominated by the Committee. In accordance with the power of nomination of further members given to them, the Committee at their first meeting on Monday, October 30, added to their number Sir Walter Gilbey, Bart., Mr. H. D. Marshall, and Mr. E. W. Stanyforth, whose appointment was reported to the Council at their Meeting held on November 1, 1899.

3. The full Committee have held two further Meetings, on December 4, 1899, and February 5, 1900, at which particulars of the recent Country Meetings of the Society have been laid before them (see Tables I. to V.) and the subject of reference has been fully discussed in all its bearings.

4. The original idea of the founders of the Society appears to have been that of holding a *district* Show in various parts of England, such Show to be specially adapted to the area for which it was intended to serve. The report of the Council to the General Meeting held on December 11, 1841 (Journal, Vol. II. p. xciii), contained a reference to the recommendations of a "District Committee," and a Schedule of nine districts in which it was suggested that the Show should be held in successive years. The Council observed thereon that they "entertain a well-grounded hope that this arrangement, in concentrating the attention of the Society to the consideration of each particular district of the series as it

comes under their notice for the purpose of selecting from it a place of meeting for the year, and in preparing the friends of Agriculture who are resident within its boundaries to receive the Society and compete for its premiums, will lead to important practical results in the well-working of the Society and the prosecution of its objects."<sup>1</sup> The division of the country into nine districts, though slightly modified in the interim, was reaffirmed by a Committee appointed at the instance of Mr. Fisher Hobbs in 1861, with the addition as a tenth district of "the Metropolis and its Postal districts" (Vol. XXII. 1861, p. vii). In 1867 Mr. Torr brought up a new scheme for a division into eight districts, which was adopted by the Council in December of that year (Second Series, Vol. IV. 1867, p. vii). This lasted until 1876, when, on the motion of Mr. Randell, another Committee was appointed, as the result of whose labours the Council reported to the General Meeting held on May 22, 1877, as follows (Vol. XIII. 1877, p. xlii) :—

The Council have revised the groupings of counties into districts for the holding of the Country Meetings in rotation, and have adopted the following scheme, to take effect after next year:—

A (1879). Norfolk, Suffolk, Cambridgeshire, Huntingdonshire, Bedfordshire, Buckinghamshire, Oxfordshire, Hertfordshire, Middlesex, Essex.

B (1880). Northumberland, Cumberland, Durham, Westmorland.

C (1881). Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, Rutland.

D (1882). Cornwall, Devonshire, Dorsetshire, Somersetshire, Wiltshire, Hampshire, Berkshire, Surrey, Sussex, Kent.

E (1883). Yorkshire.

F (1884). Staffordshire, Shropshire, Warwickshire, Worcestershire, Herefordshire, Gloucestershire, South Wales.

G (1885). Cheshire, Lancashire, North Wales.

The boundaries of these districts A to G, and the towns at which all the Society's sixty Shows have been held, are shown on the Map printed on p. 86. With the exception of a slight modification made by a Committee appointed in 1892 on the motion of Sir Jacob Wilson, making the large cities of Birmingham, Liverpool and Manchester separate centres for the Country Meetings, apart from the districts in which they are geographically situated (Vol. III. 1892, p. 363), the scheme of rotation devised in 1877 has continued until the present time. As the end of the third Rotation under the 1877 plan is now approaching, there would doubtless have been an advantage under any circumstances in reconsidering the present arrangement. But the experiences of the last twenty years, and especially the difficulties created by the ever-expanding size of the Show, appear to render it imperative for

<sup>1</sup> That this result was not at the beginning very conspicuously achieved would appear from the remark of the Senior Steward of Live Stock, Mr. Richard Milward, in reporting on the unsatisfactory entries for local breeds of cattle at the Gloucester Meeting of 1853: "We may now hope that after repeated trials with the best intentions to draw out the cattle peculiar to a district, the Society will cease to offer Prizes for any but the three recognised breeds of cattle" [Shorthorns, Herefords, and Devons]. (Journal, Vol. XIV. 1853, p. 457.)

the Council to consider afresh the whole question of the Annual Country Meetings of the Society.

5. The system under which the Society holds its annual Show in a different town each year was inaugurated at a time when one part of England knew very little of the agricultural practices and appliances of other parts, and when an agricultural show of any pretensions was a phenomenon. Out of the "Royal" Shows has sprung a system of agricultural gatherings at which the live stock and other products of different provinces, counties, districts, estates, and parishes compete one against the other; and the modern facilities of railway travelling now place within the reach of almost every one an agricultural show of adequate dimensions to satisfy the ordinary sight-seeing visitor. Organisations like the Bath and West, the Royal Counties, the Yorkshire, and the Lancashire Agricultural Societies now hold Shows which approximate in point of size to the "Royal" Shows of a generation ago; and the customary wants of the important districts of the country above mentioned may not improbably be regarded by the residents as sufficiently satisfied by the annual exhibitions in their midst of the Societies referred to.

6. For the reasons explained in the preceding paragraph, the Annual Country Meeting of this Society has ceased to be the phenomenal attraction it once was in times of less universal travel than at present. But the Show has nevertheless been usually able to hold its own as regards the number of visitors in the different towns in various parts of England in which it has taken place; and if any means could have been devised for bringing back the "Royal" Shows to the more moderate size and therefore expense of the past, the existing system of rotation might not have needed the serious reconsideration which is demanded by the ever-growing size of the Society's Showyards. The power of a Show to attract the paying public does not of course increase in proportion to its area and comprehensiveness; and attendances which were once sufficient to leave a surplus are now quite inadequate to meet the augmented expenses of a Show of larger area, increased exhibits, more exact classification, greater comprehensiveness, and much enhanced facilities to exhibitors, members, and visitors.

7. The expansion in the number and variety of exhibits both of Live Stock and Agricultural Machinery has involved a corresponding increase of responsibility and financial risk to the Society, since no more paying visitors come to the Show because it is larger than it used to be, whilst the cost of the preparations for the exhibits and of administration must necessarily increase as the Show grows in size, and as the Society, to meet the demands or needs of the public, undertakes fresh responsibilities, such as the Veterinary Examination of the horses selected by the judges in all the breeding classes (mares and fillies as well as stallions), and the laying of water-pipes throughout the Showyard, or foregoes sources of income, such as the charges to Implement Exhibitors for their entries in the Implement Catalogue (now combined with the Stock

Catalogue, and sold as one instead of two as formerly), or the premiums paid until recently by Refreshment Contractors for the privilege of catering.

8. The difficulties above referred to might be capable of solution by readjustment of entry fees if the fact that the Show-yard must now be 100 acres in extent (instead of 50 or 60 as fifteen years ago) brought with it no complications of its own. But as a matter of fact, it has come to be practically impossible to find an area of 90 or 100 acres of "level old sward land" conveniently near to the large towns to which alone the Society can take its Show with any reasonable hope of being recouped for the immense preliminary outlay which is indispensable before the doors of the Shows are open to the public. One after another, the open spaces that once existed are either (through the natural expansion of manufacturing towns) cut up for building land, or are devoted to the public as people's parks or recreation grounds. Thus, to take the most recent instances, the site on which the Society's Show was held at Leicester in 1896 is now a public recreation ground; the site at Manchester in 1897 is being developed for building purposes, and so is the site of the Birmingham Show of 1898 (even if for other reasons it were not undesirable to repeat the disastrous experiment of holding a Show seven miles away from the centre of population).

9. The receipts at the Society's Shows are governed by a great variety of considerations which cannot be expressed statistically. The Society pledges itself a year or more beforehand to a visit to a particular place; it offers prizes to the amount of several thousands of pounds six months before the event; it builds during the spring, at the cost of as many thousands, shedding for the exhibits; and the whole results of its year's work are dependent upon the efficiency of the railway facilities during the Show-week, on the then state of local trade, on the comparative popularity of other attractions in the neighbourhood, and, above all, on the continuance for five days of reasonably fine weather—in a word, on the pleasure-seeking proclivities of the moment of the residents in the district. That the relative capabilities of one town and another and of one locality and another to swell the turnstile receipts should so often have been the determining factor in the selection of a site on which the Royal Agricultural Society is to pitch its great annual gathering may be a matter of regret to those who are chiefly concerned with the educational influence of the Country Meetings; but it has been forced upon the Society by the ever-expanding and correspondingly expensive character of the Shows. But for the payments of the non-agricultural public at the doors, the Shows could not, in fact, be held at all.

10. It has never, of course, been the primary object of the Society to make money from its Country Meetings; but as its sole source of ordinary income is the annual subscriptions [of the Members, and these subscriptions—with a very few exceptions—are only 1*l.* per annum from each Member, the Society is bound to take due precautions that the general interests of the Members

shall not be prejudiced, or the usefulness imperilled of the other important departments of public work, to the continuance of which the Society is pledged, by the outlay on the Shows attaining too hazardous proportions. It is impossible to put into figures the obligations of the Society to the Shows, or of the Shows to the Society. Broadly speaking, the Show is the most generally popular feature of the Society's work, and is doubtless an excellent recruiting ground for new Members, though not to the extent that is generally supposed. The privilege of free admission to the Shows (first granted in 1861) and to the grand stands is valued by Members, and a certain small proportion of them (some 6 or 7 per cent. of the total) receive added benefits in the shape of greatly reduced fees for their entries of live stock, &c. If the Show were a separate organisation altogether, the expenses of an office and a skilled staff would have to be debited against it; but then, *per contra*, an allowance would have to be made to the Show for the advantages enjoyed by members as mentioned above. Looking, however, to the fact that the holding of the Society's Show on the scale now demanded by agricultural public opinion involves a very considerable outlay, it is obviously necessary for the Society to husband its resources as carefully as possible, and to endeavour in the general interests of the Members to limit and control the financial risks of a Show which from small beginnings has now attained a size and comprehensiveness that threaten to create serious difficulties in the immediate future.

11. It does not appear to have been generally recognised that the holding of the "Royal" Shows on their present scale involves a very considerable outlay by the Society, and, indeed, has only been possible at all by the co-operation in work and money of the Local Committees of the towns where the Shows are held. The Council drew the attention of the Members of the Society to this matter in the Report to the last General Meeting, held on December 7, 1899; and there may be advantage in reproducing the paragraphs of that Report which relate to the finances of the Maidstone Meeting:—

(7) The chief item of expenditure connected with the Society's Shows as at present organised is the erection of the sheds and buildings, and the preparation of the site for the purposes of a showyard. This cost the Society at Maidstone 8,182*l*. There is, as the Members will understand, a very large indispensable expenditure which has annually to be incurred by the Society under this head, whether the Show be large or small; but, of course, the cost of the building of the Maidstone showyard was less than that of the two large Shows in 1897 and 1898 at Manchester and Birmingham. Timber is now dearer than it used to be, and the price of labour is going up. Moreover, the Society is now under the necessity of laying water-pipes throughout the showyard, which was formerly undertaken and paid for by the Local Committee.

(8) The Society has to employ a skilled clerical staff at Hanover Square throughout the year to conduct the correspondence relating to the Show, to deal with the entries, prepare the catalogue, and transact other business connected with the Show; and this staff has to be largely augmented at the time of the Show by stewards, assistant-stewards, money-takers, ticket-sellers, foremen, grooms, yardmen, door and gate keepers, dairy

assistants, veterinary surgeons, engineers, and police. The total expense for staff and administration was this year 4,327*l.* The Society disbursed 4,791*l.* in prizes, 674*l.* for forage for the animals, 961*l.* for the expenses of the judges, 1,175*l.* for printing (including catalogues), 709*l.* for advertisements, and 313*l.* for miscellaneous expenses. These figures do not include the expenditure of the Maidstone Local Committee, amounting to no less than 8,200*l.*, in providing and preparing the site, supply of water, local prizes, expenses, and the like.

(9) The Society having once pledged itself to the holding of the Show, had practically to expend, or make itself responsible for, the whole of the items above referred to, amounting in all to 21,132*l.*, before it opened the doors of the Show to the public. It received towards the expenditure, 2,000*l.* from the Local Committee, 4,506*l.* for fees from the implement exhibitors, 1,648*l.* from entries of live stock, 240*l.* from other entries, and 216*l.* from various sources. These items only amounted to 8,610*l.*; and for the balance (12,522*l.*) of its total expenditure the Society had nothing but the admissions of the paying public to look to. Only 68,576 persons, however, passed the gates (the lowest since 1875), and as these visitors only paid—including purchases of catalogues—8,140*l.*, there was a debit balance of 6,382*l.* 1*s.* 11*d.*, which has had to be made good out of the Society's general funds.

12. A Show which involves an outlay to the Society and the Local Committee of 30,000*l.* would need much to justify it if it were to be taken up by any organisation as a new duty. But the "Royal" Shows have now been held, with the intermission of a single occasion only (during the cattle plague of 1866), for sixty years; and if they did not fulfil a useful purpose the entries for them, and the size of the Showyard, would tend to dwindle instead of to increase, as notoriously they do.

13. As already stated, the Shows are annually becoming larger and more comprehensive. It is practically impossible to set limits to the Show beyond those which have been already enforced by the Council in (1) limiting the number of feet that an exhibitor of implements can take, and (2) limiting the number of entries that an exhibitor of live stock may make in a class. A large number of exhibitors of implements find it advantageous to themselves to take space regularly at the "Royal" Show, as they there meet year by year their regular customers and find new ones; and many firms allege that they cannot make an effective exhibit of the various classes of goods they show in much less than the 100 feet run (or its equivalent) to which they are limited in the Showyard. Similarly, exhibitors of stock urge that they ought to be allowed to have the opportunity (if their animals are good enough) to win all the prizes that are offered in a class for the particular description of stock of which they make a speciality.

14. It has been suggested that the Society should (1) cut down the number of classes, or (2) offer prizes only for particular breeds of special interest in the district in which the Show happens to be held. As to (1), the decision of the majority on the Council, at the instance of the sheep-breeders, to restore the classes for Two-Shear Rams at the York Meeting, the omission of which was recommended

by the Stock Prizes Committee, is an illustration of the difficulty of limiting the Prize Sheet; and the Council are being continually urged to subdivide the classes, on the ground that it is impossible to judge satisfactorily animals of different ages (*e.g.* two-year-old and yearling bulls or heifers). As to (2), the giving of prizes for selected breeds only would destroy the national character of the Show, of which so great a point has been made by exhibitors and visitors, and would put it on a par with Societies such as the Bath and West, the Royal Counties, and the Yorkshire, at which there is probably as good an exhibit of particular breeds as at the "Royal," but which do not profess, as this Society now does, to collect into their Showyards by the offer of prizes specimens of all the recognised breeds of horses, cattle, sheep, and pigs for which there is a general market either at home or abroad.

15. Evidences of this expectation or desire on the part of breeders that the "Royal" Show shall be national and comprehensive in character are to be found in the recent inclusion of a number of classes for Polo Ponies (professedly through successive local committees, but in reality by a contribution from the Polo Pony Society), and in the decision that at York this year classes shall be given for the distant Somerset and Dorset Horned Sheep and Highland Cattle. The supporters of these and other breeds appear willing to provide the prize money for such classes; and there seems no valid reason why under a new system the Royal Agricultural Society should not be willing to accept the financial assistance of all breed societies in making the Prizes for such breeds adequate in amount and number to meet the requirements of the breed societies and exhibitors. This may be a point for subsequent consideration; but it is mentioned now as indicating that the Royal Show is regarded on all hands as the supreme arbitrament of the comparative merits of the selected specimens of the different flocks and herds of the country. As it will doubtless be the desire of the Council to maintain the supremacy of its Show in this respect, it would appear futile to attempt to put back the clock by limiting the classes in the hope of reducing the size of the Showyard.

16. The present size of the Showyard is from 90 to 100 acres; and it should all be of "level old sward land." If the Show is to be continued on the present scale, as appears inevitable from the considerations advanced in paragraphs 14 and 15, the Society cannot do with less than 100 acres of and for its Showyard. Taking this to be the case, and assuming for the sake of argument that the present system of going to different towns in various parts of the country is continued, the question arises where such a quantity of level old sward land is to be found within reasonable distance of railway accommodation and of populations sufficiently large to provide paying visitors to the Show in numbers large enough to recoup the Society for its very heavy expenditure.

17. It has already been stated that under existing conditions the Show cannot be made to pay its way without a very large attendance of paying visitors, that these visitors cannot be counted on when

the Society goes to a small town where there is no difficulty about a site, and that they can only be expected when the Society goes to a large town, where a convenient site of anything like 100 acres of old sward land is getting to be practically unattainable. Evidently, therefore, the problem—which is pressing for solution—of holding the Annual Shows without serious financial risk to the Society must be attacked from the point of view of making them more independent of the casual attendances of the paying public—which are affected by railway facilities, weather, and the thousand and one contingencies against which the Society is powerless to provide.

18. And in discussing this, the first question to be considered is : What is the real present-day object attained by the Society in holding its Annual Shows of live stock and machinery ?

Primarily the Show affords an opportunity for the exhibitors of live stock of different breeds and descriptions to pit the selected specimens of their flocks and herds against those of other exhibitors : thus through the judges' awards, indicating the best, and enabling exhibitors to see in what respects their practice or system of breeding is susceptible of improvement.

Buyers from home or abroad come to see these animals, and are guided in their purchases by the comparative merits of the animals which they see before them with their own eyes, and which they could not comparatively study in any other way.

The professional breeders acquire for their herds and flocks generally a reputation arising from the selected specimens exhibited at the Shows obtaining the hall-mark of the Society's prizes and awards.

Amateurs of live stock, farmers who do not profess to keep or breed pedigree cattle, and the general public interested in animals, see at the Shows the best specimens of the different breeds, and find pleasure and, in some cases, profit in doing so.

The assemblage of so many agriculturists and those interested in the land makes the Shows a good market for the wares of the agricultural machinist.

Landowners, land agents, and tenant farmers desirous of purchasing some new implement will defer their purchases until the Royal Show, where they can see the specialities of all the different makers ranged before them. They can see and judge these implements (as they or others do the live stock) with their own eyes, and nothing else can compensate for this.

19. It may therefore be taken for granted that, for the classes of persons referred to above, the "Royal" Shows are so great a convenience as to be practically a necessity. On the broad ground therefore of national utility, it appears that it is desirable that such a Show as the Royal Agricultural Society now organises should continue to be held, and that this Society, with its national character and its accumulated experience, is the proper body to undertake it.

20. Under modern conditions, however, the amount of financial support to the Show contributed by the persons who derive most obvious benefit from it is comparatively very small. The entry fees paid by exhibitors for entries of live stock reimburse the Society only a fractional part of the expense which they occasion ;

the fees charged to exhibitors of Implements for shedding were settled by the Special Committee which sat in 1887-8 on the basis of the actual cost of construction ; and those who are regular visitors to the Show are nearly all members of the Society who contribute nothing directly to the turnstile receipts. It has recently been argued that as the exhibitors of live stock "make the Show," as it is termed, the fees charged to them should be diminished rather than increased ; but it must be pointed out that exhibitors bring their exhibits to the Show as a matter of business and advantage to themselves, and not for the sake of the Society ; and this applies to live stock as well as to machinery. If the exhibitor felt that he did not receive directly or indirectly a *quid pro quo* for sending his exhibits to the Show, he would cease to send them ; and in any case the fees paid to the Society represent only a small part of the total expense to the exhibitors of sending their animals or machinery or other exhibits.

21. Exhibitors can hardly expect the Society to bear unassisted the very serious risk now incurred by the holding (primarily for their benefit and convenience) of a Show of the size and comprehensiveness rendered necessary by the prizes and classes demanded and the entries tendered. If the Society reaped any undue financial advantage from the holding of the Shows the case might be different ; but (independently of the cost of office accommodation, for which the Show is charged nothing, and of the cost of administrative staff, for which the Show is debited with only a fraction of its proper share) the Shows of the whole period of the Society's existence have involved on balance a loss of 33,624*l.*, which has had to be borne by the Society's general funds. Moreover, the losses of the last two Shows have swept away all the profits which accrued (on the existing basis of calculation) from the previous four Shows of the present rotation. This result has, moreover, only been attained by the voluntary contributions towards the expenses of the six Shows of 1894-9 of a sum amounting in the aggregate to over 38,000*l.* collected by the Local Committees of the places visited by the Society.

22. Assuming that the Society had, as its exclusive object, the holding of the Show for the convenience of the classes of persons chiefly interested (as defined in the previous paragraphs), and that it ignored altogether the capacity of such an aggregation of live stock and implements to attract non-professional visitors, the expense of preparing for it would be not much less than under the present system. For the stables, cattle sheds, sheep and pig pens, and parade enclosure must still be built, water laid all over the ground, and forage provided ; the implement sheds must be erected ; there must be an elaborate apparatus of judges, stewards and their assistants, veterinary surgeons, engineers, foremen, yardmen, police, and the like ; and the whole of the preliminary arrangements at Hanover Square, in recording and checking entries, preparing the catalogue, and dealing with the complicated correspondence with exhibitors, must go on as before. It is impossible therefore to consider in a practical way the problem of the Society's Shows without taking into account the situation created by the necessity of recouping the very

heavy expenditure by the contributions not only of exhibitors and professional visitors, but of the ordinary sightseer who is attracted to the Show less by the expectation of deriving some educational advantage from it than of spending a day's or an afternoon's holiday.

23. The Society's recent experiences have shown that however admirable a site, and however good the exhibits, a number of paying visitors sufficient to defray the inevitable expenses under existing conditions cannot be attracted to the Show unless it is pitched in the midst of a large resident population, or in a place with very ample railway facilities, or amongst populations accustomed to take railway journeys for their pleasure. But, as already pointed out, it is becoming increasingly difficult, and will soon be practically impossible, to find the 100 acres of "level old sward land" which the Society now requires within convenient distance of the centres of large towns, and the Birmingham experience showed that the holding of a Show in the suburbs has no effect in quickening the interest in it of the townspeople.

24. To the difficulties which have recently been experienced in the working of the old system of rotation through the absence of suitable sites, must be added those arising from the natural reluctance of the towns capable of receiving the Society to undertake at too frequent intervals the raising of the funds for providing and preparing the site and the approaches thereto, for offering local prizes, and for the subscription of 2,000*l.* towards the Society's expenses. To raise a fund of from six to seven thousand pounds in each town visited has often proved by no means an easy task for the Local Committee ; and although there has never been any disposition to shirk this responsibility when once an invitation has been tendered to the Society, yet the inevitably considerable requirements of the Society in the matter of site and the like have undoubtedly had a repressive effect (and will have more) in limiting the invitations which the Society receives.

25. Those experienced in the collection of such local funds put the interval that should elapse between one Show and another in the same town at not less than fifteen or twenty years, and up to 1899 the shortest intervals between two Shows at the same place have been 22 years (Birmingham, 1876 and 1898) and 25 years (Carlisle 1855 and 1880 ; Plymouth, 1865 and 1890). The result of the confidential inquiries which have recently been made is, it must be confessed, not encouraging as to the prospects of the Society receiving renewed invitations from the towns included in the rotation now approaching its close, or even those visited in the rotation before it. Indeed, most of these towns (except the few which have a town moor or park or large open space under the unrestricted control of the Corporation) could not again offer the same site as before, nor have they any other. On this point the following particulars collected by the Chairman of this Committee on the six Shows (1893-8) for which he acted as Honorary Director are important and significant. Mr. Parker says :—

I came into office as Honorary Director just at the end of the last rotation (finished in 1893); and I may claim, therefore, some degree of intimate knowledge as to the difficulties which have had to be surmounted, both by the Local Committee and by the Executive of the Society, in providing and preparing the sites for the purposes of the Show.

To begin with CHESTER, where I was also Chairman of the Local Committee. There was difficulty in finding a site large enough and level enough for the Show. It cost the Local Committee 260*l.* to take down the fences and restore them; the compensation to tenants, levelling and the like, cost 1,600*l.*; and the difficulties with tenants could only be settled by arbitration. Roads and sleeper-roads, water supply, &c., cost about 550*l.* Thus there was over 2,400*l.* for the Local Committee to pay for the site alone, besides the 2,000*l.* subscription asked for by the Society as a condition of acceptance of the invitation, and 1,400*l.* for local prizes, &c. Most of the site for the Show of 1893 has now been sold for building purposes, and I do not know where another is to be found in the neighbourhood of the city.

When the Society went to CAMBRIDGE in 1894, the only alternative place was St. Albans (where the Bath and West Society went afterwards and lost money). Midsummer Common, where the Show was held, was only sixty-four acres in extent, and if there had not been (owing to swine fever) a vacant space usually occupied by pigs, we could not have got all the exhibits into the space. A broad main road, recently made by the Corporation, runs right through the site; and there were endless difficulties in consequence. I do not think it at all likely that we should ever be allowed to occupy this site again, as the inhabitants would not suffer a second time the inconvenience of the road being stopped up. Midsummer Common being the property of the Corporation, the levelling and draining were considered as permanent improvements, and were not charged to the Local Committee. Roads, however, cost 252*l.*, and water supply 639*l.*

In 1895 the site at DARLINGTON was two miles off the station, and the road was more or less up-hill. The owner received 385*l.* compensation, levelling cost 287*l.*, road-making 206*l.*, and drainage, water supply, &c., 546*l.* The local fund was helped by a large grant from the Corporation (voted as "salary to the Mayor"), and 500*l.* from the North-Eastern Railway. This site is now in the hands of the son of the former owner, but from my personal knowledge I doubt very much if the site would again be available.

In 1896 the Society had two invitations, one from Northampton (population 65,000), and one from LEICESTER (population 187,000), the latter being accepted. The site was a recreation ground then just acquired by the Corporation, and included some allotments as to which there was great difficulty. "Compensation to allottees and preparation of ground" is represented in the local accounts by 1,724*l.* The site would not, of course, be available again, as it is now thrown open for the enjoyment of the public.

The Society decided of its own initiative to go to MANCHESTER in 1897, and a part of Trafford Park was prepared for the purpose at a cost to the Local Committee, including roads, of over 3,000*l.* The site is now sold, and is being developed for residential and manufacturing purposes.

The Society went to BIRMINGHAM in 1898 in view of the typhoid epidemic at Maidstone. Four Oaks Park was secured for a rent of 200*l.* plus 285*l.* for making good the damage. This site also is now being cut up for building purposes, and with our disastrous experiences as to the attendance, we are hardly likely, in any case, to go to another site seven miles away from the centre of a town.

[*Note.*—The Maidstone (1899) figures are given in the extract from the Report of the Council quoted in paragraph 11].

26. In view of all these circumstances, the Committee feel that they cannot take the responsibility of advising the Council to commit the Society to the holding of another series of Shows on the basis of the existing rotation, which would involve the shifting of the Show from one district of England to another for the next nine or ten years.

27. In the very early days of the Society, it was doubtless justifiable that, by the holding of peripatetic Shows in different districts, it should endeavour to spread the light of agricultural improvement in various parts of the country, which its influence might not otherwise reach. But the growth of education generally, and the introduction of railways, have now almost wholly neutralised the advantages of Shows perambulating the whole of England. Once every nine or ten years the Show has been held in the south of England. It cannot reasonably be averred that any educational effect has permeated the south of England because a Show was held in 1890 at Plymouth and at Maidstone in 1899. And it will hardly be contended that the Society would be justified in repeating the Maidstone experiment of risking many thousands of pounds, and actually losing without possibility of recovery 6,400*l.*, in order to bring all the latest products of agricultural skill to Maidstone for the convenience of those farmers and labourers who live within a walking or driving distance of that town. For all others, the Show might just as well have been held elsewhere, as they were dependent upon the railway service. Railways have indeed revolutionised the attendance at agricultural shows, as they have revolutionised other departments of business activity.

28. If it be conceded that the Society cannot afford in future to go to small places where there are sites, it is met with the insurmountable difficulty that if it goes to big towns, it cannot find sites for the Show. The Show, if it is to fulfil its real function, cannot be cut down in size; and so it is driven from small towns because it is unprofitable there, and from big towns because it cannot find room.

29. Under present conditions a site of 100 acres has first to be found; compensation has to be given for its use to the landlord and tenant; it has to be levelled where necessary, and drained; water has to be laid on; roads made to the entrances; an outer hoarding erected; elaborate stables built for the horses; shedding for the other live stock; shedding for the exhibits of implements, poultry, and dairy produce; a working dairy; administrative offices and pavilions; refreshment sheds; a grand stand; and a quantity of other expensive works: and *after six days' use* the whole has to be torn down again, and the site restored to its former condition.

30. This system is extremely expensive, and is wasteful both in money and strength. Each showyard is different in character and circumstances. A great deal of anxious consideration has to be given by the Showyard Works Committee, the Honorary Director, and the permanent officials, to the question of how the Society's requirements can be bent and moulded so as to fit in with the site. An expensive staff has to be maintained to prepare the site for

its Show purposes ; thousands of pounds are spent in timber, thousands of pounds in wages, and all this that (on a site not designed for a Show) a great agricultural fair may be held for a few days in the open, in the hope that the public may be attracted to it in such numbers that this huge expenditure may be recouped.

31. Taking into consideration all the facts of the case, the Committee have arrived at the conclusion that if the Society's Shows are to fulfil their proper function in the future, without an unwarrantable drain upon the Society's general resources, it would be desirable that if possible they should be held upon a permanent location near some large town (preferably in the centre of England) which would be convenient for railway access from all parts of the country. In fact, the endeavour of the Society in the future should be to bring the people to the Show, and not the Show to the people.

32. On such a site could be erected permanent buildings : entrances, pavilions, implement shedding, stables for horses, shedding for live stock and produce, grand stand, refreshment pavilions, &c., &c. Proper roads could be made to the entrances and inside the Showyard as required ; improved methods could be provided for the transport of heavy machinery ; and more convenient and satisfactory arrangements could be made for competitive and other trials of implements, dairy appliances, and the like, than have hitherto been possible in a temporary Showyard. The heavy cost of removing the Society's permanent plant from place to place would be saved ; the site could be, once for all, drained, gas and water could be laid on, and other improvements effected. There would be no large bills for wages to be paid to workmen to build a Showyard each year and to pull it down ; and generally, the work once done would not have to be done over and over again in successive years, with all manner of unsatisfactory expedients to meet the exigencies of the site, or of the moment.

33. It can be of no advantage to the exhibitors of stock to send their valuable animals about to different parts of the country, and often for very long distances to towns off trunk lines of railways. They would prefer to send their animals to a place where they could be properly sheltered in permanent buildings, without the risk of weather, wind and storm. The exhibitors of implements desire only to meet customers at the Shows ; and provided potential customers assemble in sufficient numbers, it must be better for them to have a permanent location where their clients will know where to meet them. The excursionists who come by train or road, on the cheap shilling days, are of no value to the implement exhibitors ; they order little or nothing, and are mostly sightseers of the usual kind. But the regular visitors to the Shows will come wherever it may happen to be held ; and they must now nearly all come by railway, and put up, if they make a stay of any length, with such inadequate accommodation as the place can afford, and at absurdly inflated prices.

34. Thus a permanent Showyard would undoubtedly be a convenience to (1) the members of the Society, (2) the exhibitors, (3) the regular visitors. Possibly a Show held in the same place every year might not be so great an attraction to the immediate vicinity as a Show which—to a particular district—is of abnormal dimensions, and is held there once in a generation; but it has to be borne in mind that “one Show advertises another,” and that the great agricultural gathering of the year must always attract a large number of visitors from a distance. If the Society were relieved of the incubus of the heavy annual expenditure for creating a Showyard up to date and complete in a new place every year, it could afford to dispense with a proportion of the gate money which now alone enables it to keep its head above water.

35. Financial arrangements for acquiring and fitting up a permanent Showyard having once been made, the Society could so arrange its entrance fees for stock and its charges for stands as to defray within narrow limits its expenditure for rent and maintenance, for prizes, and for staff and appliances to administer the Show, after making due allowance for the probable takings at the gates. It is certain that if the Showyard were pitched in the centre of a populous radius, there would be a large number of visitors every year to see a Show which, on an equally comprehensive scale, cannot be seen anywhere else in the United Kingdom.

36. Pending an expression of opinion by the Council on the general question of a permanent, instead of a migratory, Showyard, the Committee have not considered it within the terms of the reference to them to make inquiries as to any possible sites for such a Showyard, or to prepare estimates of expense. It is hardly likely that a site in such a position as the Society requires can be obtained at a cheap rate; but the fact that such a site would be available for other purposes during the periods of the year that the Society does not require it, might be expected to diminish the annual charge upon the Society, which must in any case be considerably less than under the present system.

[Signed] CECIL T. PARKER (Chairman).

NIGEL KINGSCOTE.	G. H. SANDAY.	W. FRANKISH.
JACOB WILSON (subject to reservation as below).		
J. MARSHALL DUGDALE.	PERCY CRUTCHLEY.	WALTER GILBEY.
H. D. MARSHALL.	E. W. STANYFORTH.	

*Reservation by Sir Jacob Wilson.*—I have signed this report subject to the reservation that I am not satisfied that every alternative to the proposed permanent showyard in one single place has been exhausted. I am of opinion that by various rearrangements the size of the showyard could be appreciably diminished, and that, by varying the composition of the prize-sheet according to the wants and circumstances of each district visited, the annual expenditure for prizes and for the preparations consequent thereon could be much decreased.

JACOB WILSON.

February 5, 1900,

TABLE I.

STATEMENT SHOWING THE EXTENT AND RESULTS OF THE VARIOUS COUNTRY MEETINGS  
OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND SINCE ITS ESTABLISHMENT.

Year	Place of country meeting	President of the year	Number of implements entered	Entries of live stock	Number of persons admitted	Financial result (+ = Profit - = Loss)
1839	Oxford . .	3rd Earl Spencer . .	54	247	—	£-1,162
1840	Cambridge .	5th Duke of Richmond .	115	387	—	-938
1841	Liverpool .	Mr. Philip Pusey . .	312	324	—	-2,166
1842	Bristol . .	Mr. Henry Handley, M.P.	455	510	—	-1,806
1843	Derby . .	Earl of Hardwicke . .	508	730	—	-8,164
1844	Southampton	3rd Earl Spencer . .	948	575	—	-2,142
1845	Shrewsbury .	5th Duke of Richmond .	942	437	—	-2,995
1846	Newcastle .	Lord Portman . .	735	613	—	-2,138
1847	Northampton	Earl of Egmont . .	1,321	459	—	-1,636
1848	York . .	Earl of Yarborough . .	1,508	718	—	-2,826
1849	Norwich . .	Earl of Chichester . .	1,882	624	—	-1,958
1850	Exeter . .	Marq. of Downshire . .	1,223	619	—	-1,629
1851	Windsor . .	5th Duke of Richmond .	—	988	—	-1,294
1852	Lewes . .	Earl of Ducie . .	1,722	655	—	-3,218
1853	Gloucester .	Lord Ashburton . .	1,808	737	36,245	-2,084
1854	Lincoln . .	Mr. Philip Pusey . .	1,897	736	37,635	-1,002
1855	Carlisle . .	Mr. Wm. Miles, M.P. . .	1,314	808	37,583	-860
1856	Chelmsford .	Lord Portman . .	2,702	752	32,982	-1,982
1857	Salisbury . .	Mr. E. Denison, M.P. .	2,496	1,027	37,342	-846
1858	Chester . .	Earl Berners . .	8,648	1,026	62,589	+1,719
1859	Warwick . .	Duke of Marlborough . .	4,618	1,159	55,577	+1,433
1860	Canterbury .	Lord Walsingham . .	8,947	891	42,304	-2,005
1861	Leeds . .	Earl of Powis . .	5,488	1,027	145,738	+4,470
1862	Battersea . .	{ H.R.H. Prince Consort Lord Portman }	5,064	1,986	124,328	-3,684
1863	Worcester . .	Viscount Eversley . .	5,839	1,219	75,807	-1,279
1864	Newcastle .	Lord Feversham . .	4,024	1,099	114,683	+1,342
1865	Plymouth . .	Sir E. C. Kerrison, Bt., M.P.	4,023	984	88,036	-743
1866	No Show . .	Lord Tredegar . .	—	—	—	—
1867	Bury St. Eds.	Mr. H. S. Thompson, M.P.	4,804	719	61,837	-2,040
1868	Leicester . .	6th Duke of Richmond .	6,869	994	97,138	+488
1869	Manchester .	H.R.H. Prince of Wales .	7,724	1,315	189,102	+2,153
1870	Oxford . .	7th Duke of Devonshire .	7,851	1,377	72,053	-2,504
1871	Wolverhptn. <sup>1</sup>	Lord Vernon . .	7,650	1,267	107,519	-2,175
1872	Cardiff . .	Sir W. W. Wynn, Bt., M.P.	5,843	1,293	85,185	-602
1873	Hull . .	Earl Cathcart . .	5,634	1,145	104,722	-414
1874	Bedford . .	Mr. Edward Holland . .	5,931	1,527	71,989	-3,717
1875	Taunton . .	Viscount Bridport . .	4,214	1,096	47,768	-4,577
1876	Birmingham.	Lord Chesham . .	6,414	1,499	163,418	+3,424
1877	Liverpool . .	Lord Skelmersdale . .	6,930	1,292	138,354	+3,947
1878	Bristol . .	Col. Kingscote, C.B., M.P.	6,837	1,354	122,042	+1,667
1879	Kilburn . .	H.R.H. Prince of Wales .	11,878	2,879	187,328	-15,064
1880	Carlisle . .	9th Duke of Bedford . .	4,196	1,485	92,011	-538
1881	Derby . .	Mr. William Wells . .	5,960	1,229	127,996	+4,526
1882	Reading . .	Mr. John Dent Dent . .	6,102	1,450	82,943	+20
1883	York . .	Duke of Richmond & Grdn	6,058	1,653	128,117	+5,190
1884	Shrewsbury .	Sir Brandreth Gibbs . .	5,241	1,664	94,126	+2,301
1885	Preston . .	Sir M. Lopes, Bt., M.P. .	5,313	1,563	94,192	+1,921
1886	Norwich . .	H.R.H. Prince of Wales .	4,656	1,823	104,909	-1,062
1887	Newcastle .	Lord Egerton of Tatton .	3,616	1,825	127,372	-2,029
1888	Nottingham .	Sir M. W. Ridley, Bt., M.P.	4,717	1,886	147,927	+4,229
1889	Windsor . .	H.M. THE QUEEN . .	7,446	8,976	155,707	-4,966
1890	Plymouth . .	Lord Moreton . .	4,148	1,764	97,141	-2,197
1891	Doncaster . .	Earl of Ravensworth . .	5,847	2,221	111,500	+104
1892	Warwick . .	Earl of Feversham . .	5,430	1,864	96,462	+3,055
1893	Chester . .	Duke of Westminster . .	5,527	2,059	115,908	+3,404
1894	Cambridge .	8th Duke of Devonshire .	6,031	1,864 <sup>2</sup>	111,658	+1,096
1895	Darlington .	Sir J. H. Thorold, Bt. . .	5,855	1,703 <sup>2</sup>	100,310	+653
1896	Leicester . .	Sir Walter Gilbey, Bt. . .	6,447	1,883	146,277	+3,600
1897	Manchester .	H.R.H. The Duke of York	7,340	2,688	217,930	+4,074
1898	Birmingham	5th Earl Spencer . .	4,958 <sup>3</sup>	2,323	98,277	-1,568
1899	Maldstone .	Earl of Coventry . .	4,231 <sup>3</sup>	1,865	68,676	-6,882

<sup>1</sup> Exhibition of Duplicate Implements prohibited after 1871.

<sup>2</sup> No Pigs either in 1894 or 1895.

<sup>3</sup> Since 1898 the exhibits in the Special Shedding have been grouped together, and do not bear separate numbers.

TABLE II.—*Summary of Receipts and Expenditure*

	Carlisle	Derby	Reading	York	Shrewsbury	Preston	Norwich	Newcastle
	1880	1881	1882	1883	1884	1885	1886	1887
<b>RECEIPTS:</b>								
Subscription from Local Committee	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Implement entry fees	3,089	4,283	4,490	4,675	4,416	4,214	3,890	3,813
Live stock entry fees	727	434	548	749	533	662	751	853
Horse boxes and stalls	323	188	175	418	359	301	374	844
Other entry fees	—	—	—	—	—	74	45	101
Catalogue sales, &c.	1,042	1,356	1,208	1,683	1,314	1,343	903	1,024
Refreshment premiums, &c.	451	600	360	285	380	435	435	375
Receipts from admissions	7,470	9,700	6,178	10,819	7,242	9,041	6,981	9,125
Receipts at stands	496	439	335	510	374	576	540	679
Miscellaneous	152	303	529	200	240	282	261	244
<b>Total Receipts</b>	<b>15,750</b>	<b>19,303</b>	<b>15,823</b>	<b>20,834</b>	<b>16,858</b>	<b>18,928</b>	<b>16,160</b>	<b>17,558</b>
<b>EXPENDITURE:</b>								
Net cost of erection of Showyard (For details see Table IV.)	5,922	5,349	5,107	4,404	4,550	5,383	5,531	6,129
Expenses at head office	Not charged before 1889							
Printing and postage. (Including Catalogue)	1,379	1,458	1,404	1,868	1,733	2,301	1,889	2,253
Advertising and bill-posting	738	748	669	931	593	1,010	726	787
Cost of forage	909	823	733	1,128	754	935	776	768
Judges' fees and expenses	495	416	377	585	525	642	595	878
Expenses of administration during Show. (Stewards, assistant stewards, clerkage during Show, foremen, yardmen, veterinary surgeons, engineers, police, &c.)	2,475	2,591	2,147	2,410	2,518	2,528	2,661	3,442
Other expenses. (Implement trials, hire of furniture, band, ambulance, and misc.)	170	670	2,354	543	356	258	272	275
Prizes awarded. (Excluding local prizes)	4,200	2,720	3,013	3,775	3,528	3,950	4,702	5,060
<b>Total Expenditure</b>	<b>16,288</b>	<b>14,775</b>	<b>15,804</b>	<b>15,644</b>	<b>14,557</b>	<b>17,007</b>	<b>17,242</b>	<b>19,587</b>
<b>Net Surplus (+) or Deficit (-) on each Show</b>	<b>-538</b>	<b>+4,528</b>	<b>+19</b>	<b>+5,190</b>	<b>+2,301</b>	<b>+1,921</b>	<b>-1,082</b>	<b>-2,029</b>

for the Twenty Country Meetings, 1880-99.

Nitting- ham	Wind- sor	Ply- mouth	Don- caster	War- wick	Chester	Cam- bridge	Darling- ton	Leices- ter	Man- chester	Bir- mingham	Mald- stone
1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
£	£	£	£	£	£	£	£	£	£	£	£
2,000	7,833	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,645	2,000
3,708	6,024	2,994	4,122	4,379	4,594	4,706	4,728	5,422	6,658	6,272	4,506
830	1,512	654	867	654	739	743	825	799	937	1,479	1,137
395	934	243	519	329	374	427	439	391	611	463	511
137	286	217	219	214	315	219	237	293	311	333	240
1,058	1,593	602	1,067	1,017	1,116	916	897	990	1,422	983	558
389	723	435	565	585	723	677	37	87	477	323	78
9,776	14,833	6,016	8,538	8,086	9,594	8,382	8,516	10,931	15,460	8,122	5,037
530	1,177	535	749	601	697	593	733	593	1,320	748	488
233	395	158	204	217	281	257	200	234	357	229	194
19,056	35,310	13,854	18,850	18,082	20,433	18,920	18,612	21,740	29,553	21,597	14,749
4,199	13,815	5,152	5,908	5,332	5,616	5,905	6,133	6,260	9,361	9,376	7,907
—	640	200	324	231	325	351	187	237	1,182	891	1,203
1,241	2,995	1,006	1,353	1,381	1,442	1,497	1,420	1,518	1,839	1,646	1,300
659	2,675	628	1,059	690	886	550	769	624	1,825	836	709
380	2,207	600	643	520	887	863	731	674	1,003	713	674
587	1,307	847	969	779	1,044	899	879	874	1,027	928	961
2,154	4,639	2,682	2,849	2,402	2,513	2,643	2,663	2,747	3,803	2,936	2,998
449	1,145	451	691	726	603	831	683	524	570	708	588
4,658	10,853	4,485	4,950	3,966	4,714	4,285	4,494	4,682	4,869	5,131	4,791
14,827	40,276	16,051	18,746	16,027	18,030	17,824	17,959	18,140	25,479	23,165	21,131
+4,229	-4,966	-2,197	+104	+2,055	+2,403	+1,096	+653	+3,600	+4,074	-1,568	-6,382

TABLE III.—Summary of Exhibits and Prizes of

DESCRIPTION OF EXHIBITS		Carlisle	Derby	Reading	York	Shrewsbury	Preston	1
		1880	1881	1882	1883	1884	1885	
IMPLEMENTS	No. of Stands . . . . .	288	377	391	401	367	360	
	No. of feet of shedding allotted (excluding open ground space) . . . . .	9,781	12,751	13,017	13,136	12,904	12,000	10
	Amount of prizes offered for Implements. . . . .	£ —	—	180	125	200	31	
HORSES	No. of classes . . . . .	52	38	38	59	47	40	
	No. of entries . . . . .	479	256	239	595	402	408	
	Amount of prizes offered . . . . .	£ 2,125	1,210	1,390	1,935	1,485	1,435	1
CATTLE	No. of classes . . . . .	60	54	49	60	65	63	
	No. of entries . . . . .	432	392	586	454	566	528	
	Amount of prizes offered . . . . .	£ 2,155	1,415	1,435	2,055	1,986	1,920	1
SHEEP	No. of classes . . . . .	40	27	31	37	30	47	
	No. of entries . . . . .	428	414	439	406	486	428	
	Amount of prizes offered . . . . .	£ 1,071	800	735	825	870	965	
PIGS	No. of classes . . . . .	20	16	20	24	24	24	
	No. of entries . . . . .	146	167	186	198	210	199	
	Amount of prizes offered . . . . .	£ 300	240	300	360	360	360	
POULTRY	No. of classes . . . . .	—	—	—	—	—	50	
	No. of entries . . . . .	—	—	—	—	—	325	
	Amount of prizes offered . . . . .	£ —	—	—	—	—	300	
PRODUCE	No. of classes . . . . .	2	7	44	11	11	24	
	No. of entries . . . . .	100	62	211	125	150	385	
	Amount of prizes offered . . . . .	£ 40	115	194	45	55	265	
COMPETITIONS	No. of entries . . . . .	—	—	—	—	—	8	
	Amount of prizes offered . . . . .	£ —	—	—	—	—	20	
TOTAL PRIZES offered, including local and other prizes . . . . .		£ 5,691	3,780	4,234	5,845	4,956	5,296	

*the Twenty Country Meetings, 1880-99.*

New- castle	Notting- ham	Wind- sor	Ply- mouth	Don- caster	War- wick	Chester	Cam- bridge	Dar- lington	Leices- ter	Man- chester	Birm'g- ham	Mald- stone
1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
283	368	553	307	421	411	408	442	393	450	489	502	395
217	10,743	15,602	9,078	12,473	12,511	13,018	13,402	12,597	13,930	15,532	15,491	12,200
435	130	152	200	285	120	130	205	60	98	326	310	140
57	49	74	48	55	41	49	55	69	61	95	78	64
493	546	968	328	713	447	509	617	650	594	981	709	424
1990	1590	3,038	1,503	1,805	1,265	1,555	1,872	2,012	1,880	3,588	2,416	1,835
64	52	82	53	52	56	72	69	64	61	75	71	71
628	646	1,637	642	661	605	758	659	548	594	821	792	683
1335	1,695	3,952	1,754	1,500	1,361	1,947	1,563	1,740	1,656	2,105	1,716	1,770
37	42	87	47	51	46	56	59	58	64	71	64	65
509	537	1,106	571	643	610	631	588	505	551	701	624	631
175	1,031	2,552	1,315	1,170	935	1,105	1,215	1,170	1,291	1,324	1,275	1,410
24	24	24	24	24	24	24	—	—	24	24	21	20
133	148	265	223	204	202	161	—	—	144	185	198	147
370	360	740	452	432	432	432	—	—	432	462	389	360
52	49	89	79	98	98	94	76	84	88	92	92	96
401	343	862	695	800	836	836	705	769	901	867	964	669
312	294	334	277	343	272	262	212	234	245	258	257	268
26	35	98	39	34	32	50	36	34	31	37	35	50
347	565	1,202	456	425	423	957	540	476	574	715	635	625
211	287	1,051	406	376	237	862	265	286	309	406	252	539
46	107	90	46	55	82	112	70	98	110	125	73	55
34	74	72	74	96	96	96	101	101	106	108	32	32
576	5,451	11,891	5,981	6,007	4,718	6,389	5,433	5,603	6,017	8,577	6,647	6,354

TABLE IV.—*Details of Expenditure*

NOTE.—The present system of building the Showyard under the direct control of the Society's own officials came first into operation at the Derby Meeting of 1881.

	Carlisle	Derby	Reading	York	Shrewsbury	Preston	Norwich	Newcastle
	1880	1881	1882	1883	1884	1885	1886	1887
Cost of timber . . . £	4,820	4,005	4,283	4,520	4,649	4,591	4,721	4,372
Canvas and roofing cloth . £	1,510	1,542	1,453	1,425	1,412	1,384	1,412	1,312
Other materials . . . £	391	447	391	470	419	325	372	452
Railway charges and cartage £	659	468	310	586	394	556	375	452
Wages . . . . £	1,551	1,451	1,324	1,646	1,709	1,841	1,901	2,112
Water piping . . . . £	—	—	—	—	—	—	—	—
Incidentals . . . . £	83	97	113	101	91	69	73	82
Surveyor's salary and expenses . . . . £	1,252	703	553	536	524	576	571	552
Depreciation of plant . . £	454	503	421	368	322	511	459	422
	10,721	9,218	8,850	9,654	9,521	9,854	9,886	9,802
LESS:								
Sales of timber . . . £	3,724	2,879	2,600	3,413	3,399	3,045	2,711	2,452
Exhibitors' works . . . £	1,073	989	1,143	1,836	1,571	1,425	1,643	1,322
Net total . . . . £	5,922	5,349	5,107	4,404	4,550	5,383	5,531	6,028

TABLE V.—*Statistics of Admissions to Showyard*

Implement day (2s. 6d.) . .	270	366	155	800	194	394	148	1,252
Judging day (5s.) . . . .	2,455	3,256	1,717	3,012	2,183	3,557	625	1,652
First half-crown day . . .	9,459	12,314	5,662	15,768	11,211	21,713	8,074	11,252
Second half-crown day . .	13,164	18,130	13,461	21,820	13,474	19,318	10,894	12,452
First shilling day . . . .	42,682	53,291	42,437	63,097	49,374	34,302	42,774	77,252
Second shilling day . . . .	23,981	40,639	19,511	24,120	17,690	14,908	42,394	24,252
Total Number of Paying Visitors at each Show . . . }	92,011	127,996	82,943	128,117	94,126	94,192	104,909	127,252

<sup>1</sup> Windsor, 1889, including 32,965 on third half-crown day (Thursday).

<sup>2</sup> Plymouth, 1889.

*Erection of Showyard, 1880-99.*

Ketting- ham	Windsor	Ply- mouth	Don- caster	War- wick	Chester	Cam- bridge	Darling- ton	Leicester	Man- chester	Bir- mingham	Mald- stone
1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
3,773	10,862	4,336	5,052	5,004	5,546	5,348	5,065	5,481	8,164	7,949	6,077
1,315	2,488	1,197	1,625	1,436	1,646	1,472	1,551	1,657	2,034	1,664	1,293
342	1,492	529	315	258	348	319	241	267	529	281	224
604	872	407	644	552	545	550	954	606	581	832	967
1,842	3,661	1,841	2,267	2,060	2,358	2,445	2,702	2,683	4,531	3,330	3,262
—	—	—	—	—	—	—	—	—	—	724	453
84	2,222	122	113	96	101	108	178	175	317	90	115
595	642	652	617	626	619	609	648	668	716	500	654
—	—	Charged in General Balance Sheet of Society since 1887.								—	—
8,558	22,239	9,087	10,635	10,034	11,164	10,853	11,343	11,539	16,874	15,323	13,047
2,836	5,613	2,607	3,050	2,880	3,633	3,108	3,068	3,304	4,750	4,259	3,651
1,522	2,811	1,328	1,676	1,821	1,914	1,839	2,141	1,974	2,762	1,687	1,489
4,199	13,815	5,152	5,908	5,332	5,616	5,905	6,133	6,260	9,361	9,376	7,907

*Payment on each day of the Show, 1880-99.*

1,826	493	194	344	266	299	260	574	172	—	256	183
1,671	6,223	1,234	2,681	3,570	2,397	1,879	2,172	1,801	4,547	2,462	1,050
11,103	18,809	10,008	12,331	16,598	20,959	13,152	12,046	17,409	22,418	10,492	8,928
9,067	24,690	39,308*	18,530	15,779	19,034	17,890	24,942	21,735	21,473	22,317	8,572
88,832	44,493	32,371	57,580	36,448	59,555	63,981	43,073	80,602	73,119	49,011	35,249
35,438	28,034	14,026	20,034	23,801	13,664	14,496	17,503	24,558	73,802	13,739	14,594
147,927	155,707*	97,141	111,500	96,462	115,908	111,658	100,310	146,277	217,980*	98,277	68,576

first shilling day.

\* Manchester, 1897, including 22,621 on third shilling day (Tuesday).



## REPORT OF CHEMICAL COMMITTEE MARCH, 1900.

### I. BASIC SLAG.

This substance, which is a refuse product obtained in the manufacture of steel, and which was at one time considered useless, has, when ground to a sufficiently fine powder, proved to be of much value as a manure, more especially in the case of grass land.

The value of the material, from the manurial point of view, lies in the phosphoric acid and lime which it contains ; but, in order that these constituents may become available, it has been found that fineness of grinding is most essential.

This fineness of grinding is entirely within the control of the producer. By proper machinery and the exercise of care, basic slag can be produced of a fineness such that 80 to 90 per cent. passes through a sieve having 10,000 meshes to the square inch, and purchasers may very reasonably insist, therefore, upon basic slag being supplied to them of this fineness of grinding.

In regard of quality, however, i.e. the percentage of phosphoric acid, or its equivalent in phosphate of lime, basic slag stands on a different footing from manufactured manures, inasmuch as the refuse from steel works varies according to the district from which the iron ore is obtained, and to the details of the process of steel manufacture. Hence qualities containing varying percentages of phosphoric acid are met with in commerce ; and, presuming these percentages are not so low as to make the railway carriage and cartage per ton a serious consideration for the purchaser, each quality may have its uses.

There are low grades of basic slag containing, say, 10 per cent. of phosphoric acid (equivalent to 22 per cent. of phosphate of lime) ; medium grades which may contain 14 to 16 per cent. of phosphoric acid (equivalent to 30 to 35 per cent. of phosphate of lime) ; while the highest qualities range from 17 to 20 per cent. of phosphoric acid (equivalent to 37 to 45 per cent. of phosphate of lime).

Under Section 1 of the Fertilisers and Feeding Stuffs Act of 1893, a vendor is bound to give the purchaser an invoice setting out the percentage of phosphates which a fertiliser contains ; and in a considerable number of instances which have come under the notice of the Chemical Committee the minimum guarantee given by vendors in the case of basic slag has been one of 38 to 45 per cent of phosphates, and 80 to 90 per cent. fineness of grinding.

From information received by the Chemical Committee, it

appears that there is not sufficient basic slag of the higher qualities produced to meet the requirements of farmers ; and there is reason to believe that a large quantity of the lower grades has been put into circulation under guarantees that are only properly applicable to the higher grades. Thus out of 30 recent instances of purchases of basic slag of which particulars have been laid before the Chemical Committee, only 8 samples came up to the guarantee, whilst of the remaining 22, no less than 16 were deficient both as regards quality and fineness of grinding.

If owing to nearness of supply, or convenience of transit, purchasers are so placed that they can more favourably buy the lower grades of basic slag, these may quite well be used, but they should of course be purchasable at a somewhat lower price per unit than the higher grades. If the amount of phosphate contained in the material, as shown by analysis, should come below the vendor's guarantee, the purchaser would be entitled to claim an allowance in respect of the deficiency : and this allowance should be based upon the unit price per ton of the phosphates contained.

Members of the Society will find it, therefore, to their own advantage when buying basic slag to have an analysis made by the Society's Consulting Chemist, and to give their orders on the forms, or in the manner laid down in the printed suggestions issued by the Society. It is there recommended that members should give their orders on the condition that the vendor "guarantees the article to be in accordance with the conditions specified on the back of the order relating to such article, and subject to the analysis and report of the Consulting Chemist of the Royal Agricultural Society of England." The conditions as regards basic slag are that it must be guaranteed to be sufficiently finely ground that not less than 80 per cent. passes through a sieve having 10,000 meshes to the square inch, and contain a certain percentage of phosphoric acid, or its equivalent in phosphate of lime.

The Committee have amended the conditions of purchase and sale of fertilisers and feeding-stuffs upon which they recommend members to insist, so as to make the conditions as to basic slag, and one or two other materials, clearer than before ; and they recommend that for the future the conditions be issued in the revised form (see Appendix, p. 91).

Two other cases of purchases of basic slag—not included in the above summary—may perhaps be usefully referred to as indicating the importance of members using the Society's forms for their Orders.

A member of the Society sent a sample of basic slag for analysis by the District Agricultural Analyst appointed by the local County Council : and the analysis showed a lower percentage of phosphate than was guaranteed in the invoice. The vendor's attention was called to this, and he offered an allowance, which allowance was not, in the opinion of the District Analyst, sufficient. But it does not appear that, under the Fertilisers and Feeding Stuffs Act of 1893, the buyer is entitled to receive from the District Analyst more than

"a certificate of the result of his analysis" (Section 5), or to ask the District Analyst his opinion respecting the money value of the article. Nor is the vendor at all bound by any such opinion expressed by the District Analyst. In the case in question the seller of the basic slag declined to increase the amount of allowance he offered. It was at this stage that the member sought the assistance of the Royal Agricultural Society. But the analysis not having been made by the Society's officials, and the Society's form of order not having been used, all that could be done was to refer the inquirer to the powers of Sections 5 and 6 of the Act of 1893, in case the vendor should take proceedings for the recovery of the debt due to him.

In the second case the buyer accepted an invoice which guaranteed only a certain percentage of phosphoric acid, but said nothing as to any guarantee of fineness of grinding. The sample, on analysis by Dr. Voelcker, was found to contain only a slight deficiency of phosphoric acid below the minimum guaranteed, but to be very coarsely ground. The buyer was, therefore, unable to enforce the claim which he desired to make on receiving Dr. Voelcker's report that the material was ground much less finely than was desirable to enable the fertiliser to have a reasonably quick action in the soil, because he had not stipulated in advance for any minimum degree of fineness, as suggested in the Society's recommendations.

Had these members given their orders for basic slag on the form prepared by the Society (copies of which are at all times at the service of members), they would have been in a much better position, since the fee charged by the Society (10s.) for an analysis of basic slag or other fertiliser includes "an opinion as to whether it be worth the price charged," and the order makes it clear that it is given, and that the fertiliser is accepted by the buyer, "subject to the analysis and report of the Consulting Chemist of the Royal Agricultural Society of England."

## II. DECORTICATED COTTON CAKE AND MEAL.

A marked improvement in the quality and condition of these feeding materials has been noticed of late; and it is satisfactory to record this, since, owing to inferiority of deliveries, there is little doubt that this valuable food and manurial agent was going out of favour. The Consulting Chemist commented in his Annual Report for 1899 (Journal, 3rd ser., Vol. X., Part IV., December, 1899) on this deterioration, mentioning that it was rare to have samples which gave as much as 10 per cent. of oil. Recent samples sent to the Society for analysis have shown a much higher average. The various samples submitted since December 1, 1899, have given the following results:—

—	A	B	C	D	E	F	G	H	J
Percentage of oil . . .	14.55	16.53	14.93	14.98	15.41	14.92	14.38	9.91	8.06
„ „ nitrogen . . .	7.02	6.71	6.50	6.36	6.51	6.50	6.99	6.69	6.98

It will be seen that all of these, with the exception of the last two, are much above the average quality of former deliveries. Almost all of them, further, were fresh and bright in colour, pure, and in good condition.

### III. COMPOUND FEEDING-CAKES.

Hardly a month passes in which some case of inferior compound feeding-cakes does not come under the cognizance of the Committee. Under the Fertilisers and Feeding Stuffs Act of 1893, the vendor of a compound feeding-cake is only compelled to state on the invoice that it is prepared from more than one substance, and he is not required to specify the particular materials used in its preparation. Members of the Society are therefore recommended, in the printed instructions issued for their guidance, to buy mixed feeding-cakes, meals, &c., with a guaranteed analysis. Any statements in the invoice as to the component parts of such mixed cake or meal will take effect as a warranty, as also will any statements in an invoice, circular, or advertisement as to the percentage of nutritive and other ingredients in any article sold for use as food for cattle.

But the Act of 1893 also provides that "on the sale of any article for use as food for cattle, there shall be implied a warranty by the seller that the article is suitable for feeding purposes" (Section 2 (3)); and any vendor who "sells for use as food for cattle any article which contains any ingredient deleterious to cattle, or to which has been added any ingredient worthless for feeding purposes, and not disclosed at the time of the sale," is liable to a heavy penalty (Section 3 (1) (c)).

Members of the Society are strongly advised therefore to give their orders subject to the analysis and report of the Society's Consulting Chemist that the material is in sound condition, and contains nothing of an injurious nature, nor ingredients that are worthless for feeding purposes.

Two cases brought before the Committee this month illustrate the above in different ways. A member gave an order on June 29, 1899, for 16 tons of a compound feeding-cake, to be delivered from June, 1899, to April, 1900, as required; and the cake was described on the invoice as "a compound of linseed, cotton-seed, and grain, cooked in treacle." He paid for the cake, receiving a small discount, on December 23, 1899. But he took no steps to have his consignments analysed until January, 1900, when (possibly having noticed a similar case recorded in the Committee's proceedings printed on page clxxx. of Part IV., Vol. X. of the Journal) he asked Dr. Voelcker's opinion of the feeding properties and market value of a sample of the cake which he sent. Dr. Voelcker reported on January 24, that "The cake has excessive moisture, and just on 4 per cent. of sand, which ought not to be present." The bill having been paid, the Member felt he could not do more than close his

account with the firm, and communicate to them Dr. Voelcker's report on their cake.

In the second case a Member ordered in December, 1899, some compound feeding-cake much vaunted by the vendors when quoting a price. But, not liking the appearance of it, he sent a sample of the cake to Dr. Voelcker, and so acquainted the vendors, adding that he would not use any until the analysis had been received. Dr. Voelcker's report, dated January 2, 1900, described the cake as "An inferior cake, of which refuse grain forms no inconsiderable part, and containing such weed seeds as spurry, cockle, polygonum, and wild mustard. The cake has excessive moisture [13.77 per cent.], and excessive sand [2.70 per cent.]."

On receiving this report, the Member communicated its purport to the vendors, and said that under the circumstances he declined to use the cake, and should return it on the ground that it contained ingredients deleterious to cattle and worthless for feeding purposes. The vendors replied, depreciating Dr. Voelcker's analyses and reports generally, and said they would have the cake analysed by the local Public Analyst, and on receipt of such analysis would place the matter in the hands of their solicitors. Later, the firm sent a copy of an analysis by a local analytical chemist who is not the Public Analyst : but the Member adhered to his decision and deposited the cake at the railway-station, whence he ascertained subsequently that it had been removed and delivered elsewhere.

E. W. STANYFORTH,  
*Chairman.*

March 6, 1900.

## APPENDIX TO REPORT OF CHEMICAL COMMITTEE.

### Conditions of Purchase and Sale.

#### FERTILISERS.

**Raw Bones, Bone-meal, or Bone-dust** to be guaranteed "PURE," and to contain not less than 45 per cent. of Phosphate of Lime, and not less than 4 per cent. of Ammonia.

**Steamed or "Degelatinised" Bones** to be guaranteed "PURE," and to contain not less than 55 per cent. of Phosphate of Lime, and not less than 1 per cent. of Ammonia.

**Mineral Superphosphate of Lime** to be guaranteed to contain a certain percentage of "Soluble Phosphate." [From 25 to 28 per cent. of Soluble Phosphate is an ordinarily good quality.]

**Dissolved Bones** to be guaranteed to be "made from raw bone and acid only," and to be sold as containing stated minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia.

**Compound Artificial Manures, Bone Manures, Bone Compounds, &c.,** to be sold by analysis stating the minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia contained.

**Basic Slag** to be guaranteed to be sufficiently finely ground that not less than 80 per cent. passes through a sieve having 10,000 meshes to the square inch, and to contain a certain percentage of Phosphoric Acid or its equivalent in Phosphate of Lime.

[The highest grades range from 17 to 20 per cent. of Phosphoric Acid (equivalent to 37 to 45 per cent. of Phosphate of Lime); medium grades from 14 to 16 per cent. of Phosphoric Acid (equivalent to 30 to 35 per cent. of Phosphate of Lime); and low grades from 10 to 12 per cent. of Phosphoric Acid (equivalent to 22 to 26 per cent. of Phosphate of Lime.)

**Peruvian Guano** to be described by that name, and to be sold by analysis stating the minimum percentages of Phosphates and Ammonia.

**Sulphate of Ammonia** to be guaranteed "PURE," and to contain not less than 24 per cent. of Ammonia.

**Nitrate of Soda** to be guaranteed "PURE," and to contain 95 per cent. of Nitrate of Soda.

**Kainit** to be guaranteed to contain 23 per cent. of Sulphate of Potash.

**All Fertilisers** to be delivered in good and suitable condition for sowing.

### FEEDING STUFFS.

**Linseed cake, Cotton cake** (Decorticated and Undecorticated), and **Rape cake** (for feeding purposes) to be pure, i.e. prepared *only* from the one kind of seed from which their name is derived; and to be in sound condition. The Report of the Consulting Chemist of the Royal Agricultural Society of England to be conclusive as to the "purity" or otherwise of any feeding stuffs.

**Mixed Feeding-cakes, Meals, &c.,** to be sold on a guaranteed analysis, to be in sound condition, and to contain nothing of an injurious nature, nor ingredients that are worthless for feeding purposes.

# ANNUAL REPORT FOR 1899 FROM THE PRINCIPAL OF THE ROYAL VETERINARY COLLEGE.

## RESEARCH LABORATORY.

DURING the year 1899 morbid specimens to the number of 380 were sent by veterinary surgeons and others to the Laboratory which was established at the Royal Veterinary College in 1890 for research in Comparative Pathology and Bacteriology, and which has since been maintained by the aid of an annual grant of 500*l.* from the Royal Agricultural Society. The number of specimens similarly sent during the preceding year was 327. As in previous years, the great majority of the specimens were forwarded for examination with a view to diagnosis. In addition to the work involved in the examination of these specimens, a number of special investigations have been carried out during the year, an account of some of which is given in this report.

## GENERAL REVIEW OF THE CONTAGIOUS DISEASES DURING 1899.

*Anthrax*.—Judging from the number of cases officially notified, this disease has fluctuated within very narrow limits during the last few years. The number of outbreaks reported during 1889 was 537, and the number of animals attacked in these outbreaks was 996. The average number of outbreaks for the three preceding years was 490, and the average number of animals attacked 877. In considering the effect of the measures which the law enforces against anthrax, it ought to be observed that it differs in one important respect from all the other diseases of which the Diseases of Animals Acts take notice. All the other diseases are caused by contagia which flourish only in the bodies of diseased animals. They could all be stamped out of existence by the slaughter of the animals already diseased, coupled with the reasonable disinfection of the places in which these animals have recently been kept, the latter measure being a necessary complement of slaughter, because, although the germs of these diseases do not multiply outside the body, they can for a time retain their vitality in the outer world. On the other hand, it is doubtful whether we should be appreciably nearer the eradication of anthrax if all the animals affected with it at any given moment were instantly wiped out of existence, and their immediate surroundings disinfected. The reason is that these proceedings would leave many anthrax germs in the soil in different parts of the country. Some of these germs may have escaped from

the bodies of diseased animals, but there is reason to believe that some of them may have come into existence in the soil, and represent the descendants, with many generations intervening, of germs that once lived in an animal affected with anthrax. It is therefore not surprising that the measures which are now put in force against anthrax have not succeeded in stamping out the disease. At the same time these measures are entirely defensible, for they are comparatively inexpensive, and they doubtless tend to prevent the disease from assuming more serious proportions, and also from being communicated to human beings. It cannot be too strongly impressed upon farmers that anthrax ought always to be suspected when an ox or cow, supposed to have been healthy, is found dead, or dies after a few hours' illness, and the cause of death, such as choking or poisoning, is not obvious. In such a case it is the duty of the owner to give notice to the police, and to refrain from interference with the carcass until it has been examined by the Veterinary Inspector.

*Glanders.*—Like anthrax, this disease has varied very little in prevalence during recent years. The number of outbreaks reported during 1899 was 851, and the number of animals attacked 1,465. The average number of outbreaks for the three preceding years was 818, and the average number of animals attacked 1,430. But the statistics with regard to this disease are in one point very fallacious, for the actual number of animals affected with the disease in any given year is probably ten times the number returned. The custom in dealing with outbreaks is to regard as glandered only such horses as show external symptoms of the disease; and this is as fallacious as it would be to estimate the frequency of tuberculosis among cattle by the number of animals that annually die from it or have to be killed in anticipation of death. The experience of the past few years does not hold out any prospect that the present method of dealing with the disease will ever succeed in exterminating it, although it is hardly open to doubt that more vigorous measures would soon have that effect.

*Pleuro-pneumonia.*—No case of this disease was detected during the past year. The last case was reported in January 1898, and it may therefore be reasonably concluded that the disease has now been actually eradicated.

*Rabies.*—The rigorous enforcement of muzzling in all districts in which cases of rabies had recently been detected has within a period of two years brought this disease to the verge of extermination in Great Britain. The total number of cases detected in 1899 was nine, but, unfortunately, one of these occurred as recently as the third week of December. It would therefore be premature to conclude that the disease has been absolutely exterminated.

*Swine Fever.*—As in the case of glanders, a balance appears to have been struck between the natural tendency of this disease to spread and the repressive effect of the measures enforced against it. The number of outbreaks reported during the past year was 2,322, as compared with 2,464 in the preceding year, and 2,155 in 1897.

Although the number of outbreaks reported during 1899 was almost the same as in the preceding year, the number of pigs slaughtered as diseased or exposed to infection was last year less by over eleven thousand.

### TUBERCULOSIS.

*Frequency of the Disease.*—A point of much interest in connection with tuberculosis, but one regarding which very little reliable information has until recently been available, is its frequency—that is to say, the proportion of animals affected with it. In the annual reports for 1897 and 1898 particulars were given regarding the application of the tuberculin test to over four thousand animals, and during the past year figures relating to the testing of 11,151 cattle have been forwarded to the Laboratory. The total number of these that reacted distinctly to the test was 2,716, while in 145 cases there was an indecisive rise of temperature. Neglecting fractions, the proportion of tuberculous animals was thus found to be 24 per cent. Adding together the figures collected for the three years, the total number of cattle tested was 15,392, and the number that reacted 4,105, or 26 per cent. It may, of course, be objected that the tuberculin test is not infallible, but the objection cannot invalidate the figures given, for the errors to which the test is liable are more likely to depress the estimate than to raise it when non-reaction is held to indicate that an animal is free from tuberculosis.

The animals tested during the past year comprised cattle of various breeds and ages, in all parts of England (with a few in Ireland, Scotland, Wales, and the Channel Islands), but the majority were milch cows. The information obtained indicates a very striking inequality in the proportion of animals reacting in different herds and in different parts of the country. In a few cases herds of considerable size (thirty or more animals) were found to be quite free from the disease, while in others more than 80 per cent. of the animals reacted. A very noteworthy fact is the rarity of tuberculosis among the cattle in the Channel Islands. The information obtained during the past year extends to a total of 81 animals tested in the Island of Jersey, and of these not one reacted. This is entirely in keeping with the information obtained during previous years. Scarcely less remarkable is the comparatively small proportion of animals reacting in the south-west of England. During the past year ten veterinary surgeons tested an aggregate of 1,175 animals in the counties of Cornwall, Devon, Dorset, and Somerset, and of these 84, or 7 per cent., reacted. By way of contrast, it may be noted that in a number of other counties six veterinary surgeons tested 2,090 animals, of which 698, or 33 per cent., reacted. Four veterinary surgeons tested 80 pure-bred Shorthorns intended for export, and 34 of these, or 42 per cent., reacted.

In endeavouring to find an explanation of these remarkable inequalities in the incidence of the disease among cattle, climatic differences naturally suggest themselves as being probable factors

in the case, but the information to hand discredits that view. Two veterinary surgeons tested 1,238 cattle in the counties of Sussex and Hampshire, and of these 501, or 50 per cent., reacted. In one district near the south coast, 264 animals were tested, and 165 of them reacted, or 62 per cent.

It is not impossible that difference of breed may be partly accountable for the varying incidence of the disease, but if that is a factor it is one which it is difficult to disassociate from the influence of the various conditions under which animals are kept. There appears to be little doubt that this latter factor has more to do with the matter than anything else; and that opinion has been expressed by several of the veterinary surgeons who have reported the figures which have been quoted above. When any considerable number of animals are dealt with, it invariably appears that close housing and bad ventilation are associated with a high percentage of reactions; and, conversely, that among cattle that are largely kept out of doors tuberculosis does not become a serious disease. In this connection the following table, furnished by a veterinary surgeon of large experience, appears to be well worth quoting:—

Total in herd	Reacted	Remarks
250	76	41 doubtful.
50	16	
71	1	
60	0	Jerseys, mostly imported. Dirty and badly kept.
54	41	
40	23	
15	1	Jerseys, home-bred.
12	4	
8	1	
23	1	" "
15	2	
7	0	
12	3	Heavy milk Shorthorns.
32	9	
6	1	
11	2	Shorthorns.
20	6	
6	0	
31	14	Cross-bred.
40	14	
46	36	
55	24	Shorthorns.
8	0	
15	1	
11	7	Badly ventilated and drained.
51	45	
25	8	
		Jerseys.
11	7	" " "
51	45	
25	8	
		Dry cows, good milkers. No drainage; ventilation bad. Mixed breeds.

One incident illustrating the inadvisability of attempting to apply the tuberculin test to animals recently removed from their accustomed surroundings may be mentioned. A veterinary surgeon reported that when, with a view to testing them, a lot of thirty Highland cattle that had been running loose in a park were driven into yards, it was found that they all had temperatures of about 105 degrees, doubtless in consequence of the excitement caused by the attempt to handle them. As there were no facilities for stalling them, the attempt to test them had to be abandoned.

*Tuberculosis of the udder.*—Additional importance has been given to the subject of tuberculosis of the udder during the past year by the fact that in the early part of the year the Local Government Board issued an Order amending Article 15 of the Dairies, Cowsheds, and Milkshops Order of 1885, so as to provide that for the purposes of paragraphs (a) and (b) of that Article, reference to disease shall include in the case of a cow such disease of the udder as shall be certified by a veterinary surgeon to be tubercular. This extension of the Order is in accordance with a recommendation made by the Royal Commission on Tuberculosis, and the effect of it is to render it illegal to mix the milk of a cow affected with udder tuberculosis with other milk, or to sell or use such milk for human food. It is very important, therefore, that the owners of milch cows should be made acquainted with the symptoms by which this condition of the udder may be recognised.

It would be wrong to affirm that the characters of tuberculosis of the udder are so sharply defined from those of other forms of udder disease as to render diagnosis always easy even to an experienced veterinary surgeon; but it is fortunately true that the great majority of other kinds of inflammation of the gland may, even by a layman, be recognised as not tuberculous.

According to our present knowledge, the characters which serve broadly to distinguish tuberculosis of the udder from the other more commonly occurring inflammations of the gland are as follows:

Tuberculosis of the udder always comes on slowly and gradually, but once it has started it continues to extend as long as the cow lives. It usually begins in one quarter, and most frequently at the upper part of it, and the first indication of it is an increased firmness of a portion of the gland. This swelling or induration is not painful or sensitive on pressure, and it is not accompanied by any heat or redness of the affected quarter. Moreover, there is at the early stage of the disease no alteration in either the quantity or the quality of the milk. It is this last feature which renders the condition peculiarly dangerous, for in spite of the normal appearance of the milk, tubercle bacilli are probably always present in it, even from the very earliest stage.

It follows from what has just been said that whenever a cow is found to have a hard, painless, slowly enlarging quarter it ought to be suspected that the condition is tuberculous. It also follows that whenever within the course of a day or two a previously healthy quarter becomes greatly swollen, hot, and tender, it may safely be

assumed that the disease of the udder is not tuberculous. Moreover, these cases of acute inflammation are further distinguished by the fact that the milk furnished by the diseased quarter is always greatly altered in appearance and much diminished in quantity. It must not be supposed, however, that the milk retains its normal appearance throughout the whole course of the attack when the disease is tuberculous. On the contrary, as the disease progresses and the quarter becomes much enlarged, the milk always becomes obviously unhealthy, being often thin and watery, with flakes or strings of curdy matter suspended in it. At a still later stage, what little liquid can be drawn off from the diseased quarter may be very thick.

The tendency of tuberculous disease of the udder to add steadily to the size and firmness of the affected quarter is a very valuable character for distinguishing it from the later stages of those acute inflammations which are attended with rapid swelling of the quarter, for as a rule in these the diseased quarter shrinks greatly after the signs of acute inflammation have passed off. Thus "blind" shrunk quarters which are decidedly smaller than the opposite healthy quarter may without hesitation be set down as not tuberculous.

Lastly, it may be mentioned as one of the negative characters of tuberculosis that the diseased quarter never bursts or discharges matter.

The more refined and more accurate methods of diagnosis—viz. microscopic examination of the milk, and experimental testing of it by injection of it into animals—can, of course, be practised only by the specialist; but certain considerations make it not out of place to refer to these also in describing for the benefit of the stock-owner how tuberculosis of the udder may be detected.

In the leaflet on the subject of tuberculosis which was issued by the Royal Agricultural Society during the past year, it was stated that in tuberculosis of the udder tubercle bacilli may be detected in the milk by microscopic examination; but it was also expressly pointed out that failure to find the bacilli by this method of examination must not be taken as conclusive evidence that the cow from which the milk came was not the subject of tuberculosis of the udder. In other words, microscopic examination of the milk warrants a diagnosis only when tubercle bacilli are detected. This statement with regard to the part which microscopic examination of the milk is capable of playing in the diagnosis of tuberculosis of the udder ought to be supplemented by saying that it is practically useless to resort to microscopic examination, except when some of the before-mentioned signs of disease are present in the udder. It is doubtful whether anyone ever detected with the microscope tubercle bacilli in milk from an apparently healthy udder. This must not be taken to mean that the bacilli are never present in the milk until the disease has advanced so far as to be manifested by some alteration in the gland easily recognisable by examination during life, for in probably every case the milk contains the bacilli

for a short period before the diseased part has attained such a size that it can be detected by manipulation of the udder. The microscopic examination, however, is of little or no value at this stage, because the number of bacilli present is so small in proportion to the amount of milk that it would be almost hopeless to expect to find them except by devoting an unreasonable amount of time to the search. This point does not appear to be generally understood, for samples of milk from apparently healthy udders are every now and again sent to the Laboratory with the request that they may be microscopically examined and an opinion given as to whether the cow in question is free from tuberculosis of the udder or not.

It also appears to be desirable to refer in this connection to the method of testing milk by experimental inoculation. This is unquestionably the most delicate test at present known for the detection of tubercle bacilli in milk, but if it is to be used to ascertain whether a particular cow is the subject of tuberculosis of the udder it is absolutely necessary to observe certain precautions in taking the sample of milk that is to be submitted to examination. It will not do to simply pour some of the cow's milk from the ordinary milking-pail into a bottle that has merely been rinsed out with water. When milk thus taken is sent to a bacteriologist he will be able to determine by experimental inoculation whether tubercle bacilli are present in it or not; but in the event of his detecting that they are present, there will still be room for doubt as to whether they actually came from the interior of the cow's udder, or accidentally found their way into the milk from the hands of the milker, the dirt on the teats or udder, the bottle, or the milking-pail, which may have retained some bacilli from the milk of another cow.

*Tuberculosis of the sheep.*—The comparative exemption of the sheep from tuberculosis is a remarkable fact, in view of the great prevalence of the disease among cattle, and its far from infrequent occurrences among pigs, horses, dogs, and poultry. There would, of course, be nothing remarkable in this exemption, any more than there is in the exemption of sheep from contagious pleuro-pneumonia, if tuberculosis were not a disease communicable to the ovine species; but the sheep has no absolute immunity against tuberculosis, for occasional natural cases of the disease among these animals are met with, and sheep may be experimentally infected without any difficulty either by inoculation or feeding.

In evidence of the rarity of the disease among British sheep, it may be stated that there has not yet been placed on record one indubitable case in this country. On many occasions the writer has had brought under his notice what were alleged to be examples of tuberculosis in the sheep; but when the affected parts were forthcoming for examination the disease always turned out to be of some other nature, most frequently nodular lesions caused by worm parasites. On account of its rarity, considerable interest therefore attaches to the following case.

In the month of December 1898 part of the side of a sheep seized in a slaughter-house was sent to the laboratory by Mr. W. F.

Shaw, F.R.C.V.S. On the inner aspect of the chest-wall and on the upper surface of the breast-bone there were some clusters of nodules very like the so-called "grapes" which are so frequently found in tuberculosis of cattle. All these nodules had a fibrous capsule, enclosing contents which were completely caseous and partially calcified, except in the case of one at the hinder end of the breast-bone, which contained soft caseo-purulent material. The appearance of these lesions naturally suggested that they were tuberculous, and, indeed, it was for verification of that diagnosis that Mr. Shaw had sent the parts to the Laboratory. A microscopic examination did not reveal any tubercle bacilli in the diseased parts; but in spite of this it was still suspected that the disease was tuberculosis, and with a view to obtaining positive evidence to that effect a little particle of the soft material from the nodule near the end of the breast-bone was introduced under the skin of each of two rabbits. This experiment was performed on December 10, 1898. One of the rabbits died on April 19, and the other on May 13, 1899, and the lesions found in them were almost identical in the two cases. There was some disease at the place where the matter had been introduced under the skin, the nearest lymphatic glands were enlarged and caseating, and numerous tubercles were present in the lungs and kidneys. Tubercles were also present in the liver of one of the rabbits, but they were absent from the spleen in both. All doubt as to the nature of the disease in the sheep was set at rest by finding that tubercle bacilli were present in the lesions in the rabbits.

From the rabbit which died on May 13 another was inoculated, using for the purpose a particle of matter from the enlarged and caseating lymphatic gland in the axilla. This third rabbit died from tuberculosis on August 20, and from a tubercle in one of its lungs a fourth was inoculated. It died on December 10, with tuberculous disease of the lymphatic glands, lungs, and kidneys. From the lungs of this rabbit tubercle bacilli were obtained in pure culture.

It would have greatly enhanced the interest of this case if the history of the sheep had been obtainable, but nothing could be learned with regard to that, and it is therefore impossible to say how the disease was contracted. As has already been stated, this is the first undoubted case of tuberculosis in the sheep that has been recorded in this country, but every year a number of such cases are detected in the large German slaughter-houses. Probably the more frequent occurrence of the disease among German sheep is ascribable to the greater frequency with which sheep in some parts of the Continent are housed during the winter months, for there can be little doubt that it is in large measure the open-air existence of the sheep which secures for it an almost complete exemption from tuberculosis in this country. The beneficial effect of an open-air mode of life in this respect is probably not so much due to its invigorating effect, as to the obstacles which it places in the way of infection from animal to animal.

**A NEW DISEASE OF THE DOG.**

In the early part of last year reports regarding the occurrence of an obscure but very fatal disease among dogs reached the Laboratory from several towns in the South of England. The fact that a large number of dogs were seized within a short period with severe illness, having for its chief symptoms great prostration and persistent vomiting, led to its being at first supposed that the animals were being poisoned. This explanation, however, had to be abandoned when it was ascertained that precisely similar outbreaks had occurred simultaneously or in quick succession at various places.

About the time when the disease was beginning to attract attention in this country, an account of what appeared to be the same malady was published in a German veterinary journal, and a comparison of the symptoms and lesions described in this German article with those observed in the outbreaks in this country soon made it quite clear that the disease was the same in the two countries.

The first serious outbreak of the disease in Germany appears to have occurred in Stuttgart during the autumn of 1898, but the same disease is said to have been observed in several other German towns, notably in Frankfurt, Hamburg, and Wiesbaden. The disease appears to have first shown itself in Stuttgart soon after a dog-show had been held there, and it was surmised that the infection had been introduced and spread by some of the animals exhibited at the show. Whatever may have been the origin of the disease in Germany, there is reason to believe that cases of the same nature occurred in Scotland in the early part of 1898, some months before the date of the Stuttgart outbreak.

In a note presented to the Veterinary Committee of the Society in March 1899, mention of the occurrence of this disease in England was made, and its appearance in Europe was then regarded as a remarkable illustration of the sudden development of a new disease of a contagious or infectious character. It appeared certain that the disease could not be identified with anything described in veterinary literature; but information more recently acquired makes it not improbable that the disease may after all not be new, for Veterinary-Captain Pease of the Indian Civil Veterinary Department has informed the writer that, after reading a description of the alleged new disease, he recognises it as one which he has on many occasions seen among dogs in India. If this view is correct, it may quite well be that the disease was introduced into this country from India.

In order to account for the spread of the disease it has been assumed that it is contagious or infectious, but few if any of the attempts to transmit it experimentally have been successful. In times not yet very remote the appearance of the disease would have been set down to some so-called atmospheric influence, but such an attempt to explain the origin of the complaint would land

one in greater difficulties than those that appear to stand in the way of its being regarded as contagious ; for one cannot believe that there was anything peculiar in the climatic conditions or in the composition of the atmosphere in Stuttgart in the autumn of 1898, or that the same subtle changes set in at all the other towns in which the disease broke out, while at intermediate places atmospheric conditions remained normal. Moreover, one cannot imagine what atmospheric condition could have caused the severe inflammation of the stomach which was characteristic of the disease in the dog and yet be without any injurious effect on the stomachs of the human beings and other animals living in the same places. One must, therefore, continue to believe that the disease is spread by contagion or infection, in spite of the fact that it is not readily transmitted experimentally. Fortunately the disease seems to have been less prevalent during the latter part of the year, but whether it will die out altogether or make a permanent home in this country it would be impossible to foretell.

As already mentioned, the principal symptoms are great prostration and persistent vomiting. Another symptom which is nearly as constant as these, and much more valuable for diagnosis, is ulceration of the lining membrane of the mouth, attended with a peculiar discoloration of the membrane and a fetid character of the breath. About 75 per cent. of the dogs attacked die, the average duration of the illness in fatal cases being from four to six days. The post-mortem examination discloses intense inflammation of the stomach, and usually of some portions of the intestine also.

As soon as an outbreak has developed it is readily distinguished from distemper by the fact that with few exceptions the animals attacked are adults and many of them old dogs.

#### SARCOPTIC MANGE OF CATTLE.

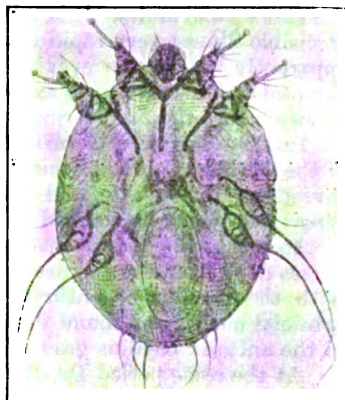
So few cases of sarcoptic mange affecting cattle have been recorded in veterinary literature, that doubts have even been raised as to whether it occurs at all. In Neumann's standard text-book on the animal parasites it is said that its history is limited to the possibility of its existence. The following observations, made during the past year, establish its occurrence beyond the possibility of doubt.

In the month of January last some scurf from the skin of a cow was brought to the Laboratory by Mr. Thackeray, veterinary student, for identification of the parasites which it contained. A very brief examination of the parasites confirmed the diagnosis which Mr. Thackeray had already made, and showed that they undoubtedly belonged to the genus *Sarcoptes*. It was then ascertained that the scurf had been taken from a cow under treatment by Mr. Carless, M.R.C.V.S., of Stafford, and through the kindness of that gentleman an opportunity to examine the animal was obtained. It proved to be a three-year-old Shorthorn, which had been purchased at Bingley Hall in the month of September previous.

It showed no symptom of skin disease at the time of purchase, but soon after it was brought home it was noticed to be rubbing, and the skin began to assume an unhealthy appearance. When it was seen in January it was rather poor, although it had been in very good condition when sold. Almost the entire skin had become affected, including that of the legs down to the top of the hoofs. There had been extensive loss of hair, and the skin was thick, grey, wrinkled, and dry. At some places it had become thrown into thick folds. Only a few scabs or crusts had formed where the animal had recently rubbed itself.

In some scurf scraped from what seemed to be the parts most recently invaded, numbers of acari were without much difficulty found with the microscope on the return to the Laboratory. A photograph of one of these is reproduced in the accompanying illustration.

The sarcoptic acarus, it may be explained, is the most formidable of the mange parasites, owing to its habit of burrowing into the depth of the cuticle, whereas the other two common varieties live on the surface of the skin. A good many cases of mange of undetermined character have been reported as occurring among cattle



Sarcoptic acarus from mange of the ox.

in various parts of the country during the last year or two, and in quite a number of instances the disease was believed to have been contracted during exhibition at a show. It is not improbable that some or all of these were cases of this sarcoptic mange, and in view of its very contagious character it is desirable that care should be taken to exclude from shows animals exhibiting any symptom of the disease.

#### AFRICAN HORSE-SICKNESS.

According to Dr. Edington, the remarkable equine disease which is known locally as horse-sickness has been more or less prevalent in South Africa for more than a century. It appears to be enzootic in certain districts, but for the most part in Cape Colony and Natal it manifests an epizootic character, carrying off at intervals immense numbers of horses. Some measure of the great losses which it has occasioned may be formed from the estimate that in the two years 1854-55 it carried off in Cape Colony alone 64,850 horses, representing a value of 525,000*l*. That appears to have been the most serious outbreak of this century, but the deaths from the same cause during the most recent epizootic are computed to have been over 14,000.

Within the districts in which the disease maintains an enzootic existence, it appears to have a regional distribution and to exhibit a tolerably regular seasonal variation—that is to say, it occurs with regularity or with especial frequency in particular tracts of land and at a particular season of the year. Few or no cases occur during the South African winter, and in most districts in which it prevails it shows an annual recrudescence, said to be heralded by the first few hot moist days of summer. The advent of frost generally puts a stop to the disease for that season. It is very doubtful whether the disease attacks any other species of animal than horses and mules. It is terribly fatal, and, judged by the period of visible illness, very rapid in its course. In many cases animals apparently well in the evening are found dead next morning, and symptoms of actual illness are seldom exhibited for more than a day or two before the fatal termination.

In 1894 Sander, a German naval medical officer, at the request of the German Colonial Society, went out to South-west Africa to investigate the disease, and in the following year he published a report,<sup>1</sup> in which he claimed to have demonstrated by bacteriological methods that the disease was anthrax. He found in the blood of horses dead from the sickness a bacillus agreeing in size and form with the bacillus of anthrax, and he cultivated this organism on artificial media, and found that its cultures had all the characters of the anthrax bacillus grown on the same media.

At the same period Dr. Edington, Director of the Bacteriological Institute, Graham's Town, was also conducting investigations regarding horse-sickness, and in 1895 he published a very valuable report, giving the results which he had obtained up to that date. To Dr. Edington belongs the credit of having been the first to give a tolerably full and clear account of the symptoms and lesions of the disease, and of having proved that it was not anthrax. He also was the first to show that horse-sickness can with great certainty be communicated to horses by inoculation with blood from an animal dead of the disease, and that it has a very definite duration and period of incubation. With regard to these points, the experiments which have been made at the Royal Veterinary College during the past year furnish almost complete corroboration of the account of horse-sickness given by Dr. Edington in the report referred to.

But Dr. Edington also claimed that he was able to detect with great constancy in the blood of horses dead of horse-sickness a species of fungus, which he provisionally named the *Oedemamyces*. He found it in the blood of 24 out of 25 consecutive cases of horse-sickness, and expressed himself as satisfied "that in all horses dying of uncomplicated horse-sickness, after a period of nine or ten days' illness (counting from the moment of infection), this body is present." Needless to say, he inferred from this fact that the fungus in question was the cause of the disease. This is the one important

<sup>1</sup> Archiv für wissenschaftliche und praktische Thierheilkunde, 1895.

point in connection with Dr. Edington's researches with which the observations made at the Royal Veterinary College are in sharp conflict. As will presently be shown, the so-called *Oedemamyces* is not present in the fresh blood of horses dead of horse-sickness, and it is most assuredly not the cause of the disease, since blood which does not contain it is capable of transmitting the affection to healthy horses by inoculation.

For an opportunity to institute experiments regarding horse-sickness the writer is indebted to the kindness of Mr. W. Robertson, M.R.C.V.S., late assistant to Dr. Edington, who, on his return from Africa in August last, brought with him a small quantity of blood from a case of the disease.

The experiments which have been made at the Royal Veterinary College show that horse-sickness is readily transmitted by subcutaneous inoculation of the blood of a previous subject of the disease. With regard to that point they merely confirm the results obtained by Dr. Edington. But they also appear to show that the disease is with equal facility transmissible by introducing the blood into the stomach. This point cannot be said to be quite new, for Dr. Edington has described an experiment in which a horse contracted the disease after it had had a quantity of horse-sickness blood administered to it by the mouth. In that case, however, it was considered probable that the infection had resulted from inoculation through some small wound accidentally inflicted during the act of drenching. That can hardly have been the case in the experiments made at the Royal Veterinary College, for unusual care was taken not to wound the mouth in administering the mixture of blood and water. It cannot be considered as remarkable that the disease should be experimentally communicable in this way, for it appears to be almost certain that infection by the mouth must be the method in which the disease is usually contracted in South Africa.

The most important point, however, which has been established by these experiments is that the hypothetical germ of horse-sickness passes freely through a Berkefeld or a Chamberland filter. This is most conclusive proof that the organism encountered by Dr. Edington in the blood of animals dead of horse-sickness is not the cause of the disease, for no structure of the size of the so-called *Oedemamyces* can pass through either of these filters. But the successful experiments with filtered blood prove much more than that. It follows from them that if horse-sickness is caused by a bacterium—and regarding that point there can hardly be any doubt—the germ must be very much smaller than any of those with which we are acquainted. It has recently been shown that the germ of bovine pleuropneumonia, when present in a watery liquid, will pass through the pores of either a Berkefeld or a Chamberland F. filter, but it is stopped by either of them when it is suspended in an albuminous liquid, although it is so small as to be almost invisible even under the highest magnification possible with the microscope. It has also been shown that the cause of foot-and-mouth disease when present in a watery

liquid will pass through the before-mentioned filters, but it also is stopped when the liquid is albuminous, and it has not yet been made visible with the microscope. All the bacteria which are so large as to be distinctly visible with the highest powers of the best modern microscopes are arrested by one of these filters from water, and the most putrid of liquids can be made germ-free by passing it through one of them. But, as previously stated, the germ which is the cause of horse-sickness is not stopped by these filters even when it is suspended in a liquid that contains a large proportion of albumen, such as blood serum. It therefore appears to be highly probable that the germ of this disease is so minute as to be invisible to the human eye even when aided by the highest powers of the microscope.

The investigation of the disease is being continued, especially with a view to the discovery of a method of prevention.

#### THE CURABILITY OF GLANDERS.

Experience has shown that of the apparently healthy horses that are discovered to be affected with glanders by the employment of mallein only a small proportion subsequently become ill or develop any external symptoms of the disease. At first sight the fact might appear to stand to the discredit of the mallein test, and to be easily and naturally explained by assuming that a great many horses react to mallein without being really glandered. This explanation, however, is quite untenable, for all those who have had any considerable experience in making post-mortem examinations of horses that have recently reacted to mallein are agreed that the test is one of great reliability. With rare exceptions, the post-mortem of a horse that has recently reacted to mallein discloses the characteristic lesions of the disease in the lungs or elsewhere. Assuming, therefore, that, with rare exceptions horses that react to mallein are really glandered, two possible explanations of the fact that few of them subsequently become clinically glandered suggest themselves. The first is that, contrary to the view at one time universally accepted, glanders is not a very serious disease, in the sense that in many horses it runs a mild course, and does not seriously disturb the animal's general health. The second explanation is, that while glanders left to itself is a very virulent and fatal complaint, many cases of it are in the early stage cured by a single injection of mallein. The first explanation is probably the correct one, although the second view is held by a number of veterinary surgeons in this country. When the mallein test is applied to a large stud of horses among which glanders has existed for a period of years, it frequently happens that a notable proportion of the animals react—perhaps 20 per cent. or more—although for a number of years previously the proportion of animals that have developed symptoms of the disease may have been very much smaller than that. It is this experience which justifies the view that, altogether apart from any curative effect of mallein, many cases of glanders run a mild course, and ultimately end in complete recovery.

Valuable evidence as to which of the suggested explanations is the correct one might be obtained by taking a large stud in which glanders has been in existence for years, and dividing the horses at random into two equal lots, on the assumption that each lot would contain an approximately equal number of cases of glanders in the so-called occult stage. All the horses in one of the lots might then be tested with mallein, and afterwards kept under observation for a year or more, in order to note how many of them developed external symptoms of glanders. The other lot would be left untested, but kept under similar observation. If a much larger number of cases of clinical glanders manifested themselves in the lot that had not been tested with mallein, the fact would indicate that the mallein had actually had a curative effect on the animals of the other lot. It would probably be difficult to obtain the sanction of the owner of any large stud to have the plan suggested put into execution, and as a pure experiment it would necessarily be very costly.

In view of the interest attaching to the question, it was decided to test the curative effect of mallein on a horse manifestly glandered. This, of course, is not quite the same problem as the one just discussed, which relates only to the alleged curative influence of mallein on horses that appear to be healthy and are known to be glandered solely by a reaction to mallein. But, while it must be admitted that glanders might be curable at an early stage and incurable at a later one, the difference between some so-called occult cases of glanders and others of clinical glanders, as regards the extent of the disease, is not great; and assuming that the former are curable by mallein, one would naturally expect that some of the cases showing external symptoms of the disease ought also to be amenable to this treatment.

An opportunity presented itself in the month of October, 1898, in the shape of an aged gelding which had recently developed clinical symptoms of farcy.<sup>1</sup> One of the hind legs was much swollen, and a few characteristic farcy "buds" were present on it.

The animal was tested with mallein on November 4, and it reacted in quite a typical manner, both as regards the rise of temperature and the characters of the swelling which formed at the seat of injection. The rise of temperature following the injection of the mallein was as shown below:—

Temperature at time of injection	.	.	.	.	Degrees
" " 8th hour afterwards	.	.	.	.	101.4
" " 10th " "	.	.	.	.	103
" " 12th " "	.	.	.	.	104
" " 14th " "	.	.	.	.	104.8
" " 16th " "	.	.	.	.	105
" " 16th " "	.	.	.	.	105.4

<sup>1</sup> Farcy is quite the same disease as glanders, and it may be defined as glanders affecting the skin or subcutaneous tissue. With rare exceptions, horses that are the subjects of farcy are also "glandered," in the sense that they have glanders nodules in their lungs.

During the next three months the horse was submitted to repeated, gradually increasing, doses of mallein, and under this treatment it appeared to make a complete recovery. The injections were then stopped for a month, at the end of which it was tested with an ordinary dose of mallein and failed to react.

On the assumption that the horse was cured, it appeared to be of interest to determine whether it had also been protected by the combined effect of the first attack of farcy and the large doses of mallein. To test this point it was inoculated into one of its veins on June 13, 1899, with virulent glanders pus from a guinea-pig, and some of the same material was injected under the skin of the neck. An ill-defined swelling formed at the place where the material had been injected under the skin, but this disappeared after about a month. The animal did not develop other external manifestations of glanders, but when it was tested with 1 c.c. of mallein on June 23, it displayed a typical reaction, and a like result was obtained when the test was repeated on July 7 and 22. On each occasion there was a large swelling at the seat of injection. The temperature after the test on June 23 was as follows:—

Temperature at time of injection					Degrees
					101
"	after 6 hours	.	.	.	102
"	" 9 "	.	.	.	103
"	" 12 "	.	.	.	104·8
"	" 15 "	.	.	.	105

The fact that the horse reacquired the power of reaction to mallein after inoculation with virulent glanders bacilli indicated that its previous failure to react was due to its having really recovered from the disease, and it also showed that it had not acquired a very high degree of immunity.

The horse was again tested with 1 c.c. of mallein on August 17, and it again reacted well, the temperature rising from 102·6° to 105·2°, and a large, slowly disappearing swelling forming at the seat of injection.

The test with the same dose was repeated on September 14, and the reaction this time was less. The temperature rose from 102° to 104·6°, but the local swelling was small, and did not increase after the 24th hour.

The horse was tested for the last time on October 12, and on this occasion it failed to react.

A few days after the last test it was observed that the animal was out of sorts, and it soon developed pronounced symptoms of pleurisy with effusion. It died on October 22, and the post-mortem examination was made two hours afterwards.

This revealed general acute pleurisy, with about three gallons of liquid in the chest. The lungs contained some dozens of tubercles, each about the size of a barley-grain, and with an opaque white centre. No other lesions of glanders were discoverable.

No bacteria of any kind were discoverable with the microscope

in the inflamed pleural membrane, or in the liquid in the chest, and potato and other media inoculated from these developed no growth. Moreover, inoculation experiments with the tubercles in the lungs and with the liquid in the chest failed to infect animals.

It was unfortunate that the case was complicated by the onset of an attack of pleurisy, which was probably in no way connected with the disease (glanders) from which the horse had previously suffered. Acute pleurisy in the horse is sometimes caused by glanders bacilli, but the inoculation experiments prove that this case was certainly not of that nature.

Reviewing the whole history of the case, the observations would appear to show that this horse, although showing external symptoms of farcy, became quite cured (or recovered). Afterwards, when inoculated with virulent glanders bacilli, it again contracted the disease, and it had again recovered before it died from another cause. It would be dangerous to infer from this one case that mallein exerts a curative influence on glanders, though that is a perfectly legitimate interpretation of the results. It ought to be pointed out, however, that the quantity of mallein used was very large, and that the period over which its administration was spread was a long one. The case, therefore, does not lend much support to the view that 1 c.c. of mallein used for the purpose of diagnosis may suffice to cure an attack of glanders that otherwise would have developed until it caused death.

It is hoped that an opportunity to repeat the experiment on a larger scale may be obtained during the current year.

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## REPORT BY THE CONSULTING CHEMIST ON EXPERIMENTS IN WEED-PREVENTION AT WOBURN.

IN accordance with a suggestion made by Mr. Albert Pell,\* the Botanical Committee of the Society determined, at the beginning of last year (1899), to carry out inquiries as to the conditions favourable or otherwise to the spread of weeds in particular localities. It was resolved to direct attention, in the first instance, to two plants in particular, viz. wild poppy and wild oat, in order to discover what practical means exist for checking their growth or prevalence.

The recently established Pot Culture Station at Woburn seemed to present special facilities for the solution of these problems. The system of growing plants in pots enables a large number of experiments to be carried on side by side, and it permits of the employment of soils other than those of the immediate locality—conditions which are not to like extent, or with such facility, afforded by field experiments. Moreover, in an inquiry such as the present, where there was little or nothing by way of previous experience to go upon, the experiments had to begin, so to say, in the dark; and it is desirable to try in such cases, at the outset, a number of different applications or methods of treatment, in the hope that possibly one or the other may prove to be sufficiently encouraging in its results to warrant the trial of it on an extended scale in the field. This is one of the great advantages of the "pot-culture" system, enabling, as it does, a selection to be made from a number of preliminary or tentative experiments, for subsequent application on practical lines.

Though the inquiry was, as stated, limited, in the first instance, to wild poppy and wild oat, nevertheless, as there were facilities, the actual experiment was extended to the case of two other weeds, both of them prevalent in the Woburn neighbourhood, viz. wild onions and annual chrysanthemum.

The experiments were carried out partly in zinc pots placed on stands within the wire enclosure of the Pot Culture Station, and partly in earthenware cylinders sunk in the ground in the open. These cylinders were simply ordinary earthenware drain-pipes rather over 2 feet in depth and 15 inches in diameter. Three such cylinders and eight zinc pots were set apart for each of the four kinds of weeds in question. In the zinc pots the weeds, or soil believed to abound with them, were grown alone, i.e. without a crop; in the cylinders a corn crop (barley) was grown along with the weeds.

1. WILD POPPY (*Papaver Rhæas*).

The eight zinc pots were filled on May 1, 1899, with soil from one of the fields of the farm which frequently grows poppies, and, for greater certainty, wild poppy seed was sown as well on May 11 in the pots. The seed, however, is one with a very hard covering, and it was found very slow to germinate. Despite these precautions the poppies never came up in the pots, and, so far as these were concerned, the experiment was a failure. Nevertheless, as the soil grew a plentiful crop of other weeds, observations made on these may not be without point. The chief weeds that appeared were *Veronica* (speedwell), *Senecio* (groundsel), *Chenopodium* (goose-foot), *Capsella* (shepherd's purse), and *Polygonum aviculare* (knot grass).

With the eight pots the treatment was as follows :—

- Nos.  
 1 & 2. Nothing.  
 3 & 4. Sprayed with ammonia liquor from gas works.  
 5 & 6. Treated with salt at the rate of 5 cwt. per acre, and subsequently sprayed with a 2 per cent. solution of sulphate of copper.  
 7 & 8. Sprayed with carbolic acid solution.

The gas liquor was applied on July 12 ; it was diluted with its own volume of water, and the solution actually applied contained 1·47 per cent. of ammonia and ·22 per cent. of sulphur. 50 cubic centimetres per pot was used. By that time the weeds aforementioned were abundant on these and the other untreated pots. The gas liquor caused *Veronica* and *Senecio* (when not too far advanced) to disappear entirely. *Chenopodium* and *Capsella* also were partly destroyed, and the only weed entirely unaffected was *Polygonum aviculare* (knot grass).

Salt applied on May 11 at the rate of 5 cwt. per acre, dissolved in water, produced absolutely no effect, and so spraying with sulphate of copper was subsequently (July 12) tried. Some of the plants had some of their leaves browned, but the weeds were none of them seriously injured when they had reached this later stage of growth. Carbolic acid solution (1 per cent.) produced even less effect.

This being so, ammonia liquor, in double the strength of the solution used above, was tried, and the effect of this was to shrivel up all the weeds with the exception of *Chenopodium* and *Polygonum*.

Meantime the three cylinders, filled with the same soil, and sown also with wild poppy seed, were planted on May 8 with barley. The barley grew well throughout. One cylinder was left untreated, one was to be sprayed with ammonia gas liquor, and the third treated with salt at the rate of 5 cwt. per acre. In these experiments the poppy plants did appear. The results of the treatment on the other weeds were much as in the case of the pots.

Ammonia liquor (the weaker strength), 100 c.c. per cylinder, and salt did not injure the poppies at all.

It may be here noted that in another experiment detailed later (wild oats), poppies, though not specially sown, came up freely, and their luxuriance was much increased by the use of nitrate of soda.

The general outcome of this trial was to show that gas liquor used in its full strength (containing 2.93 per cent. ammonia) would kill all the weeds mentioned except *Polygonum* and *Chenopodium*. The practical uselessness of salt at the rate of 5 cwt. per acre, and of carbolic acid (1 per cent.) and sulphate of copper (2 per cent.), was also demonstrated.

## 2. WILD OATS (*Avena fatua*).

On the Woburn farm there is no field on which wild oats flourish regularly, but it had been noted on Stackyard Field that on plots of the continuous barley series where ammonia salts (sulphate of ammonia and muriate of ammonia) had been freely applied, the land itself being poor in lime, while the barley failed under the continuous and heavy manuring, oats both wild and cultivated came up luxuriantly. It was thought, therefore, to determine whether treatment with soluble nitrogenous salts influenced wild oats favourably or not under ordinary circumstances. Hence some of the soil of this field, though not from the exhausted plots, was used in this experiment. At the same time it must be noted that wild oats are generally found on stiff lands, and not on sandy land like that of Woburn.

As in the former case, eight zinc pots and three cylinders were employed.

Wild oat (*Avena fatua*) seed was obtained and sown in both, and barley was sown in the cylinders on May 9, but not in the pots.

With the pots the treatment was—

- Nos.  
 1 & 2. Nothing.  
 3 & 4. Sulphate of ammonia, 2 cwt. per acre.  
 5 & 6. Nitrate of soda,  $2\frac{1}{2}$  cwt. per acre.  
 7 & 8. Ammonia gas liquor.

With the cylinders—

- No.  
 1. Nothing.  
 2. Sulphate of ammonia, 2 cwt. per acre.  
 3. Nitrate of soda,  $2\frac{1}{2}$  cwt. per acre.

In both sets the wild oats came up well, and other weeds too. In the cylinders wild poppies appeared among others.

Sulphate of ammonia and nitrate of soda were applied on June 21 and 22, dissolved in water. Ammonia liquor, of the same strength as in the wild poppy experiment (1.5 per cent. ammonia and .22 per cent. sulphur), 50 c.c. per pot, was applied on July 12.

As this did not affect the barley crop or the wild oats, a dressing of the double strength was given on July 29. This did not affect either the wild oats, *Polygonum*, or *Chenopodium*, but killed the other weeds in the pots. Nor did sulphate of ammonia or nitrate of soda affect the wild oats in either the pots or the cylinders. There were, however, most wild oats in the cylinder to which no nitrogenous salts had been added ; and what was remarkable also was that wild poppies were in much greater abundance where sulphate of ammonia and nitrate of soda had been used, more especially nitrate of soda, and the barley did not thrive so well in these cases. The general conclusion would seem to be that nitrogenous top-dressings are more favourable to wild poppy than to barley, and less favourable to wild oats than to barley.

### 3. WILD ONION (*Allium vineale*).

This weed, fortunately, does not grow on the Woburn farm ; but on a farm not far off, of stiff character, it thrives greatly, and is a perfect "pest." As is known, wild onion grows in patches, rather than distributed evenly over a field.

Six zinc pots and three cylinders were utilised for this experiment, being filled with soil from a field of the farm just named. The materials tried were (1) lime at the rate of 4 tons per acre, worked into the top soil ; (2) superphosphate, at the rate of 6 cwt. per acre ; and (3) spraying with carbolic acid solution.

In neither set, however, did the wild onions appear during the season, though their presence in the soil was proved by their suddenly springing up in December after the experiment was over. Transplanting of actual plants from the field was tried, but did not succeed either. Hence there would be nothing to record but for what followed subsequently, and which may lead possibly to results in the future. When the wild onions appeared in December and grew vigorously it was determined to try spraying them with a 10 per cent. solution of carbolic acid. This was done on December 13, the solution being poured on the soil in one of the pots. By December 20 the plants were injured, and by January 1 they were all dead. This by itself would be nothing remarkable, but the interesting point was the action on the soil. From the time of the application until January 10 the soil smelt distinctly of carbolic acid, but by January 20 the smell had entirely disappeared. The drainage water was collected at intervals throughout, and by January 20 it was found that it no longer gave any indication of carbolic acid in it. It now remains to be seen whether on land so treated barley can be successfully grown ; for, if so, seeing that wild onion grows in patches, it would be quite feasible to put carbolic acid solution on the spots affected, let the land lie during the winter, and by spring—if, as in the case of the experimental pots, the carbolic acid was removed from the soil—no injurious effects from its use would be left, and barley or other spring crop might be sown.

This is what will be done with the experimental pots in the coming spring.

#### 4. ANNUAL CHRYSANTHEMUM, YELLOW OX-EYE, OR CORN MARIGOLD (*Chrysanthemum segetum*).

This weed, again, does not thrive on the Woburn farm, but fields on adjoining farms suffer greatly from it, more especially when spring corn is sown. It is a most difficult weed to get rid of and comes up again and again, even cultivation for turnips not seeming to eradicate it. The wheat crop, however, seems strong enough to keep it down.

Soil from a field of one of the above farms was taken and filled into ten zinc pots and three cylinders. In this instance, though no seeds were sown, the soil did, happily, yield the desired weed in abundance. Along with it came up also a large amount of spurry (*Spergula arvensis*). The pots had, as before, no corn crop, and were treated as follows :—

- Nos.  
 1 & 2. Nothing.  
 3 & 4. Superphosphate, 6 cwt. per acre.  
 5 & 6. Sulphate of potash, 2 cwt. per acre.  
 7 & 8. Salt, 5 cwt. per acre.  
 9 & 10. Sprayed with sulphate of copper (2 per cent.) solution.

The cylinders were treated as follows :—

- No.  
 1. Nothing.  
 2. Lime, 2 tons per acre before sowing the barley.  
 3. Sulphate of iron.

As regards the pots, it will suffice to say that while superphosphate and sulphate of potash effected no good, and salt seemed only to slightly reduce the total amount of weeds, sulphate of copper partly destroyed the spurry but not the chrysanthemum. Ammonia gas liquor was, on July 12, put on one of the pots where other treatment had failed, and, in the half-strength solution, showed signs of doing some injury to the weed. It was then applied in full strength, i.e. undiluted, and in two days it shrivelled up all the chrysanthemum and spurry, but (as in other experiments noted already) did not affect the *Polygonum* (knot grass). As no corn was grown in these pots it could not be said what the effect on the corn would have been.

It was, however, in the case of the cylinders that the most striking effect was seen—viz. that which resulted from the application of lime at the rate of 2 tons per acre, the lime having been lightly mixed with the top soil the day before barley was sown in it. This effect is clearly shown in the illustrations opposite.

While chrysanthemum and spurry were very abundant in the two cylinders 1 and 3, in cylinder 2, which had had 2 tons of lime per

acre, there was no spurry whatever, and only four small plants of chrysanthemum, against fully twenty in the other cylinders. In these latter the weed duly flowered, but there was no flowering in the lime-treated cylinder. The barley was allowed to ripen and the corn was weighed. In the lime-treated cylinder there was three times as much weight of barley grain as in the untreated one where the chrysanthemum and spurry had full play.

This experiment with lime proving so successful, it was thought to try the application of lime to one of the pots where chrysanthemum had already grown strongly. This treatment was found to



Illustrations showing the effect of applying lime to soil infested with annual chrysanthemum, and barley subsequently sown. The weed is very prominent, and the barley stunted where no lime has been put on, but where lime has been applied the weed is almost entirely destroyed, and the barley grows well.

injure the spurry considerably, but did not destroy the chrysanthemum. So it is clear that lime, to be effectual, should be applied before the corn crop is sown.

Sulphate of iron did not prove advantageous, and ammonia gas liquor tried subsequently injured the spurry but not the chrysanthemum.

Experiments, on a practical scale, by applying lime before a corn crop is sown, might now well be tried on land infested with this weed.

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13 Hanover Square, London, W.

February 24, 1900.

## SECOND REPORT BY THE CONSULTING BOTANIST AND THE CONSULTING CHEMIST ON THE GRASS EXPERIMENTS CONDUCTED BY THE SOCIETY.

ABOUT the year 1894 the attention of the Society was called to many pastures over the country that were in poor condition, and supplying little food for stock. The matter was referred to the Chemical and the Botanical Committees with the view of instituting experiments for the improvement of such pastures. In 1895 the members of the Council were invited to ascertain whether there were any suitable and available pastures in their respective districts on which experiments could be carried on. The various localities which were in this way suggested were visited by the Consulting Chemist and the Consulting Botanist of the Society, with the view of determining the nature and condition of the existing vegetation, the character and composition of the soil, and the relation the proposed experimental fields had to the neighbouring pastures.

The result of these inquiries led to the selection of twenty-two fields in eleven different counties of England, fairly spread over the country from Hampshire to Durham, and from Essex to Hereford. These sites were representative of much of the pasture in the districts in which they were situated.

Nearly every field selected had as its predominant grass, Twitch or Bent Grass (*Agrostis vulgaris*, With.). This is perhaps the most worthless grass in our British pastures. It is the last to be eaten by stock, and is then eaten only when there is no other food to be had. Stock prefer Yorkshire Fog (*Holcus lanatus*, Linn.) to Twitch. But it should be noted that both Twitch and Fiorin (*Agrostis alba*, Linn.) when made into hay are eaten and are nutritious. Some of the experimental fields had scarcely any other grass than Twitch in the pasture, and in them the creeping stems or *stolons* formed a spongy mass, an inch or more in thickness, which completely smothered all other vegetation. Being rejected by animals, every plant in the pastures produces seed. The small seed is easily blown about by the wind, and consequently this grass is one of the earliest to take possession of land allowed to tumble down.

Next to Twitch, several of the pastures contained a large proportion of Yorkshire Fog; and other grasses not favourites with stock, such as Dog's-tail (*Cynosurus cristatus*, Linn.), Sweet Vernal (*Anthoxanthum odoratum*, Linn.), and Brome Grass (*Bromus mollis*, Linn.) were frequent.

Three localities were overrun with weeds which, from the poverty of the soil, were small and starved plants.

In some places the vegetation consisted of good grasses, but

they were stunted and wiry. The soil was thin and exhausted, or was liable to be dried up in hot seasons.

To obtain a better plant it was resolved to re-sow without breaking up the surface, or, as it is sometimes called, to "renovate" with the seeds of better grasses. In the case of the pastures that were composed almost entirely of Twitch, attempts were made to break up the matting of stems covering the surface of the soil by light harrowing and cross-harrowing, a somewhat costly operation. The torn-up stems were removed from the field and burnt. It was unfortunate that the spring and summer of 1896 were hot and dry, and consequently the small seeds, having to germinate above ground, were dried up and killed before the roots got possession of the soil. In a few cases the sowing was repeated in the following year, but unhappily with similar results. This part of the experiments was, consequently, a complete failure, and no modification was obtained in the composition of the pasture. The breaking up of the matted stems of the Twitch produced satisfactory results in the pastures where this was done.

The majority of the soils in the experimental fields were clayey, grading from stiff clays to clay-loams. Two were sandy loams. The soils were analysed, and their defects as shown by the analyses were kept in view in the manurial applications. The manures employed in the experiments were basic slag, either alone or with kainit, and, in a few cases, with nitrate of soda in addition, lime, bones, salt, and dung. The quantities are specified under each experiment.

The experiments were conducted on plots of one acre each in the part of each field selected as being most suitable for the purpose. The plots were usually marked out by short posts driven in at the corners, but a more efficient plan was employed by Mr. Frankish at Limber, Brocklesby, Lincolnshire, by running a draining plough round the boundaries of each plot. The plots were not further separated from the remainder of the field, the stock not being in any way hindered from access to them.

The experimental fields have been visited by the Chemist and Botanist of the Society each year since the experiments were initiated, and the results have been noted. In the first Report on these experiments, published in March, 1898, in Vol. IX. of the Society's Journal, pp. 137-172, will be found details of the state of the pastures in which the experiments were carried on, the analyses of the soils, and the plan of each experiment, with the general conclusions arrived at to the close of 1897. The present Report deals with the results of these experiments during the four years, 1896-99, in which they have been carried on. A letter with inquiries was sent in January, 1900, to the gentlemen who were locally carrying on the experiments. The answers received, together with the official reports, have been digested for the present Report.

1, 2, 3. Of the plots mentioned in the Report of 1898, Nos. 1, 2 (Bedfordshire), and 3 (Essex) are experiments in laying down to pasture which are not sufficiently advanced to report upon finally.

**4. CHESHIRE.—Tatton Park, Knutsford.**

The soil is a good loam, in some places very thin. A portion railed off was broken up and cultivated for four years, two years in grain and two in roots. Perennial grass seeds were laid down with the last grain crop and a good pasture of vigorous grasses followed. The pasture of the Park consists mostly of Twitch, which has formed with its prostrate stems a thick matted covering to the soil and has almost extinguished all other vegetation. Experiments had been carried on for some years in the Park, and it was found that lime and basic slag had been very beneficial; and consequently lime had been spread over considerable areas of the Park with manifest advantage. A portion was selected for experiment which had been limed about fourteen years previously, and the benefit obtained was still visible in the greener colour of the area and the more thorough eating of the pasture by the stock. Five acres were selected from this area, and they have been treated per acre as follows:—

1. Harrowed and re-seeded.
2. 4 tons of Buxton lime, applied December, 1895; cost 2*l.* 8*s.*
3. 5 cwt. of basic slag, applied December, 1895, and 5 cwt. October, 1896; cost 19*s.* 6*d.*
4. 5 cwt. of basic slag, applied March, 1896, and 5 cwt. March, 1897; cost 19*s.* 6*d.*
5. No manure.

Dung was applied to the right half of each plot throughout. This made a manifest gain over and above the benefit from the other manures.

The harrowing was a great gain to the plot, no less than fifty loads of the matted stems of the Twitch being removed in this operation. The seeds sown did not get possession of the ground, but in course of time the blown seeds filled up the bare spaces.

The *lime* plot was distinctly the best in 1897, exhibiting a fresh greenness that separated it from the other plots; in 1898 it was well eaten down, and this was its characteristic also in 1899.

The *basic slag* plots showed no difference between application in the winter and in the spring. In 1897 these plots, though much improved, were not equal to the lime plot. In 1898 the dunged halves had given a greater yield and were more eaten down than the undunged halves. This was also the case in 1899, and they all still continued inferior to the lime plot.

**5. CHESHIRE.—Smoker Field, Tabley Grange, Knutsford.**

The soil is a light sandy loam. The analysis showed that the soil had very little vegetable matter for a grass field, was deficient in lime, and had almost no phosphoric acid.

Four plots of one acre each were staked off and were treated in the following manner:—

1. 4 tons of lime; cost 40*s.*
2. 8 cwt. of basic slag; cost 20*s.*
3. 5 cwt. of boiled bones; cost 20*s.*
4. No manure.

The upper half of each plot had an application of dung in April,

1896, at the rate of 15 loads per acre ; and the half of this dunged portion was harrowed throughout and re-seeded. The harrowing was done in January, 1896, and the mineral manures were applied immediately the harrowing was finished. The seeds were sown in April.

The harrowed portion at the dunged end of the plots, and occupying a quarter of the whole, had a younger growth of grass which the stock liked.

The lime could be detected as helping the pasture in the autumn of 1896, but in 1897 it produced a greener and fresher appearance, and this part of the field was more eaten down than any other plot.

The basic slag also made some, but only a very little, impression on the crop, and the plot was fairly eaten down.

The boiled bones did not appreciably modify the pasture.

Believing that the experiment was finished with the experience of the 1897 growth, Mr. Ashworth had the field broken up, and he reports as to the influence of the manuring on the subsequent crops. In 1898 the field was in corn ; the influence of the lime could be traced in the crop to almost an inch, and scores of farmers noticed this. In the following year, 1899, the field had a potato crop, and the limed plot had almost double the crop of the rest of the field. The plot with boiled bones came next to it. Mr. Ashworth adds that from his experience he does not believe that anything will exterminate the "Fog Bent" (*Agrostis vulgaris*, Linn.) short of ploughing, cleaning, and re-seeding, and this opinion is certainly borne out by the experiments.

#### 6. LINCOLNSHIRE.—Mill Plats Field, Limber, Brocklesby.

The soil is sandy with some clay, and is fairly deep with a clay subsoil.

The analysis of the soil showed it to be deficient in lime, to have a good proportion of phosphoric acid, but not much potash, and to be poor in nitrogen and vegetable matter. The manures applied per acre were the following :—

1a and 1b. Harrowed for re-seeding.

2a. 8 cwt. of basic slag.

2b. 4 cwt. of mineral superphosphate.

3a. 6 cwt. of basic slag and 3 cwt. of kainit.

3b. 3 cwt. of mineral superphosphate and 3 cwt. of kainit.

4a and 4b. 4 cwt. of bone meal.

5a and 5b. 12 loads of dung.

The b plots had, in addition to the manures specified, a dressing of lime at the rate of 4 tons per acre. The lime was put on in January, 1896, the artificial manures early in February, and the dung rather later.

The addition of the lime to the b plots had a marked effect by greatly improving the quality of the herbage, which was manifested by the way in which the stock kept it down. The harrowing of plot No. 1 induced a growth of new plants to spring up, and made the pasture more palatable to the stock, and this was especially so in the limed half. The seeds that were sown never got possession of

the ground, and did not in the least modify the pasture. In 1899 plot No. 1a had returned to the state it was in before the plot was harrowed. No. 1b is still in better condition from the application of the lime.

The *basic slag* plot was in 1897 decidedly improved, but it did not equal the other half of the same plot which had on it superphosphate and lime. In 1898 the relative position of these two manures was reversed. The basic slag was best and continued so in 1899. In both parts of the plot there was a considerable quantity of white clover.

The plot with *basic slag and kainit* had in 1897 a good deal of clover and the herbage was distinctly improved, and this improvement increased in the following year. The plot was kept closely eaten down, and this continued to be its condition in 1899.

The *mineral superphosphate, kainit, and lime* plot produced a fairly heavy crop, but it did not find favour with the stock and remained somewhat rough throughout the season 1897, and this continued to be its condition through the two years that followed.

The *bone meal* produced no apparent good in 1897, but the influence of the lime on the half to which it was applied was shown in the appearance of some clover, and the more thorough way in which the plot was eaten down. The bone meal without the lime produced no obvious alteration. In 1898 there was a slight improvement from the bone meal alone, but the twitch and other grasses were not improved in quality and were left by the stock to grow and seed. The limed portion was decidedly better, but there were patches of untouched Twitch and Yorkshire Fog in it.

The heaviest crop in the experimental plots was produced by the *dung*, and specially on the limed half. This was obvious in 1897, but much more so in 1898. There was a compact growth of white clover over the plot, and the herbage was closely eaten down. The clover was abundant in both halves of the plot, but was more luxuriant in the limed half. The contrast of this plot to the unmanured portion beyond was very remarkable. In 1899 this plot showed the same characteristics.

The judgment of Mr. Frankish as to the experiments is that the lime has produced a marked improvement, and after it the farm-yard manure. But beyond these he does not attach much value to any of the other applications, and their influence is decidedly becoming exhausted. The white clover is increased on all the plots to which the lime was applied, and these portions are more grazed by the stock. Some of the neighbours have made inquiries as to the experiments, and several have, as a result, been experimenting with basic slag.

7. NORTHAMPTONSHIRE.—Willow Field, Home Farm, Laxton Park, Stamford.

The soil is a strong clay loam with fragments of oolitic limestone scattered through it, and resting on a heavy clay subsoil. At the bottom of the field it becomes a stiff, dark, clay loam. The grass had been laid down for seven or eight years, but was so inferior

that part had been ploughed up. From the remainder, consisting of about six acres, four plots of an acre each were selected and given to experiment upon. The grasses were starved, having only a few inches of clay loam to live on.

The analysis of the soil showed that it had plenty of vegetable matter, potash, and nitrogen, with a great deal of lime, and a fair amount of phosphoric acid. The portion of the field selected for experiment was divided into four plots of an acre and a half each, one being without manure. The others were treated as follows :—

1. 12 loads of dung.
2. 18 loads of road scrapings.
3. 8 cwt. of basic slag.

The manures were applied in January, 1896. Mr. Hornsby applied, to a strip running along the end of each plot, salt at the rate of 5 cwt. per acre, but this has not produced any change. No indication of improvement was discernible in any of the plots in the autumns of 1896 and 1897, but in 1898 the *basic slag* had a heavier yield, with a fair amount of white clover. In January, 1899, Mr. Hornsby applied basic slag again to this plot at the rate of 8 cwt. to the acre. This plot continued to improve in 1899, leaving the ground well covered with grass intermixed with an abundance of clover, both white and alsike.

The *dung* had decidedly bettered the pasture in 1898, though it was much inferior to the basic slag. On May 5, 1899, a considerable dressing of wood ashes was added to this plot, but this did not further improve the pasture.

The *road scrapings* slightly modified the plot in 1898. On February 21, 1899, 20 loads of soil mixed with lime were applied to this land, which further acted on the crop, though the plot was not so good as the dung plot.

#### 8. NORTHAMPTONSHIRE.—Laxton Park, Stamford.

The soil is a thin loam, resting on a stiff, impenetrable subsoil. The herbage consists chiefly of Twitch, with lesser quantities of Yorkshire Fog, Sweet Vernal and Dog's-tail, and large patches of Brome grass. The turf is very compact, and covered by the creeping stems of the Twitch. There was scarcely any clover in the park. Four acres were selected for experiment, and the following manures per acre were applied in January, 1896 :—

1. 8 cwt. of basic slag.
2. 2 tons of gas lime.
3. 12 loads of dung.
4. 4 cwt. of mineral superphosphate.

On the *basic slag* plot a quantity of clover has appeared, and the grasses were increased in quantity and improved in quality. In 1898 the clover had greatly increased and the plot was well eaten down by the stock. In March, 1899, 3 cwt. of superphosphate was added to the plot and 1 cwt. of nitrate of soda. Mr. Hornsby reports that the ground is better covered with herbage, and it is eaten down very clean.

The *gas lime* killed much of the herbage, and the bare spots

were occupied by young grasses naturally sown. A little clover appeared and the plot was very green.

The *dung* induced a vigorous growth in the pasture, the larger grasses making a good show. This was maintained in 1898 and 1899, though the plot was yet far behind the basic slag one.

The *superphosphate*, like the dung, produced a more vigorous growth ; in 1898 the plot had not so strong a growth, and it was no better in 1899, though it was still markedly superior to the rest of the park.

In answer to the inquiries sent to him, Mr. Hornsby says that all the manures did some good for the first year, but, with the exception of the basic slag, they showed symptoms of exhaustion after the second year. He adds, however, that the dung plot continues to look green.

The stock have eaten all the plots better than where no manures were applied, but the basic slag plots have been throughout the best and the most liked.

The experiments have been helpful in dealing with other pastures, for the remarkable benefits following the use of basic slag have led to the use of it on all the other pasture lands in Mr. Hornsby's occupation. The plot in the park where the basic slag was used in 1896 has steadily improved year by year, and through the dry summer of 1899 there was certainly more white clover and better pasture than in any previous year.

The farmers in the neighbourhood have not taken much interest in the experiments as a whole, but from the occasional visits they have paid to the experimental plots they acknowledge the value of basic slag, though they say it is too expensive for them to use. Cases are specified where the influence of the basic slag in the experiments has led to its successful employment elsewhere.

9. BUCKINGHAMSHIRE.—Broadfield, No. 2033A, Home Farm, Latimer.<sup>1</sup>

The soil is a light loam, 8 inches deep ; the subsoil is a heavy clay, 6 feet deep, resting on chalk. The field, 30 acres, has been in grass for eighteen years, and has in the ordinary course been always grazed.

Lime was deficient in the soil, which was also poor in phosphoric acid and nitrogen. It was accordingly resolved to make up these defects in the manurial applications. Six acres were set apart and they were treated as follows :—

1. Pond mud.
2. 12 loads of dung.
3. 5 cwt. of salt ; cost 10s.
4. 3 cwt. of superphosphate and 2 cwt. of kainit ; cost 12s. 6d.
5. 8 cwt. of basic slag ; cost 1l.
6. No manure.

<sup>1</sup> The two experiments, 9 and 10, at Latimer were not visited in 1899, and Mr. W. Calcott-Stokes, who was good enough to inspect and report on the plots in January, 1900, has only recently had charge of the estate, and was not acquainted with the previous progress of the experiments.

One-half of each plot had 2 tons of lime applied as well as the manures proper to the plot. The lime cost 2*l.* per acre. It was applied in the last days of 1895 and the first of 1896, and the pond mud at the same time. The other manures were applied on January 27, 1896, except the dung, which was not applied till February 8.

The drought of 1896 prevented the manures from taking effect, except in the case of the *dung* plot, which was certainly improved. In 1897 it again yielded the heaviest crop, and in 1898 it was only behind the basic slag. Mr. W. Calcott-Stokes, after a careful inspection of the crops on January 19, 1900, could discover no difference between the experimental crops and the surrounding land.

The *basic slag* presented a good growth, with a considerable quantity of clover, in 1897, equal to that of the dung. In 1898 there was a heavy crop on this plot, but plants of white clover showed themselves only here and there. This plot was, in 1899, the best crop on the field.

The *superphosphate and kainit* yielded a crop nearly as good as the basic slag in 1897, but in the following year it was not so good.

The *pond mud* in 1897 presented scarcely any difference from the no-manure plot. It was somewhat better in 1898.

The *salt* had produced no result either in increasing the amount of food or in improving its quality.

The *limed half* of the plots exhibited in 1897 a clear improvement in the quality of the food. In the half of the no-manure plot the herbage was closely grazed. In the following year the differences between the halves of the plots were not so obvious.

10. BUCKINGHAMSHIRE.—Field No. 2058, Home Farm, Latimer.

This field is on the face of a hill. Under cultivation the soil has been gradually carried towards the bottom. On the upper part of the field it is very thin, a clay loam scarcely covering the chalk.

The nearness of the underlying chalk gives a fair amount of lime to the soil in this field. It was resolved to experiment here with six 1-acre plots, and they were treated as follows :—

1. 10 loads of dung.
2. Pond mud and lime.
3. 2 tons of lime ; cost 15*s.* 6*d.*
4. 6 cwt. of basic slag ; cost 15*s.*
5. 6 cwt. of basic slag and 2 cwt. of kainit ; cost 1*l.*
6. 3 cwt. of superphosphate and 2 cwt. of kainit ; cost 12*s.* 6*d.*

The manures were applied in January, 1896, except the dung, which was put on in the middle of February.

The very dry season of 1896 prevented the manures from having any visible effect on the pastures.

The *dung* plot produced the most herbage in 1897, but there was no clover in the plot, and moss was abundant, and in 1898 it was behind, but very close upon, the basic slag plots.

The *basic slag* decidedly improved the plot in 1897, a considerable quantity of clover appearing, and in 1898 this plot produced the

best and most palatable pasture. The addition of the *kainit* to the *basic slag* made no appreciable improvement in the plot as compared with the *basic slag* alone.

The *superphosphate* and *kainit* made a good show in 1897, being equal to the *basic slag*, but in 1898 it fell off and was little better than the rest of the field.

The *lime* plot had some clover, and the herbage was more palatable in 1897, but it did not show much improvement in 1898 over the unmanured parts of the field.

The *pond mud* and *lime* produced a vigorous but patchy growth in 1897, but did not maintain this in 1898.

Mr. W. Calcott-Stokes doubts whether any real gain has resulted from the experiments at Latimer, but he is unable from his own knowledge to give a trustworthy opinion. The tenants on Lord Chesham's estate, as well as others in the neighbourhood of the two fields, have taken some interest in the experiments.

#### 11. HAMPSHIRE.—Woodgarston Farm, near Basingstoke.

The soil is a clay loam, with a stiff clay subsoil resting on the chalk. The field is fifteen acres in extent, and had been in grass twelve or fourteen years, being generally fed. It is on high, exposed ground and easily burns up in a dry season.

The soil had a fair proportion of lime, rather little potash, and was deficient in phosphoric acid and nitrogen. Six acres were devoted to the experiment, and the following manures were applied :—

1. 2 tons of lime ; cost 1*l*.
2. 5 cwt. of *superphosphate* and 2 cwt. of *kainit* ; cost 17*s*. 6*d*.
3. 8 cwt. of *basic slag* ; cost 1*l*.
4. 15 loads of dung.
5. 4 cwt. of dissolved bones ; cost 1*l*. 4*s*.
6. This plot was left without manure.

The manures were applied in January, 1896. No effects were observable that year, except in the case of the *dung* plot, which produced the largest crop, though there was less clover than in some of the others. In 1897 this plot showed well, being next to that with the *basic slag* and equal to the limed plot. In 1898 it fell far short of these two plots, but was decidedly better than the no-manure plot, while in 1899 it was hard to distinguish it from the no-manure plot.

The *superphosphate* and *kainit* plot was the greenest and most closely-eaten plot in 1897, but it was inferior to the *basic slag* and the *lime* in 1898, and was coming very near to the no-manure plot in 1899.

The *basic slag* plot was next to the *superphosphate* and *kainit* in 1897, was decidedly the best in 1898, retained that position in 1899, and gives promise in January, 1900, on the testimony of Mr. Wm. B. Canning, of giving a better result, if there is good growing weather in the coming spring and summer, than the *lime* plot, which is, however, nearly as good.

The *lime* plot took a position in 1897 next to the *basic slag* and equal to the *dung* ; in the following year it maintained its position

relatively to the basic slag, and, through the exhaustion of the dung, was greatly better than that plot; in 1899 it was practically equal to the basic slag, though Mr. Canning's estimate in January, 1900, of this year's growth is not as favourable as that for the basic slag.

The *dissolved bones* plot has not at any time shown an improvement on the no-manure plot.

Mr. Canning further reports that the stock do not appear to have shown a preference for any particular plot. Since the experiments began more clover has appeared in the lime and basic slag plots, and these are the only plots in which the manures have shown any continued improvement. As the result of these experiments basic slag has been applied to other pastures of similar character, but the benefit is not apparent, probably owing to the dry seasons. No interest has been taken by the neighbouring farmers in the experiments, and they have made no practical use of them.

12. DURHAM.—Bell Hills, Binchester Whins Farm, Bishop Auckland.

The soil is a clay loam, resting on the boulder clay.

The soil has a fair proportion of potash, phosphoric acid, and nitrogen, but is deficient in lime. The field, twenty-three acres, has been in grass for fifty years, and has been grazed with cattle. Five acres were selected and treated as follows:—

1. 12 loads of dung.
2. 6 cwt. of basic slag and 2 cwt. of kainit.
3. No manure.
4. 8 cwt. of basic slag.
5. 2 tons of lime.

The manures were applied in January, 1896.

The *dung* gave an improvement in 1896; in 1897 it had the heaviest yield of grass, though there was not much clover in the plot. The appearance of the crop was no doubt due to the dislike of the stock because of the presence of the strong farmyard manure; in 1898 the influence of the manure again produced a heavy crop, which was, however, fairly eaten down by the stock; this continued to be the condition of the plot in 1899.

The *basic slag and kainit* plot was improved, and in 1897 was fairly well eaten by the stock, and a considerable amount of clover appeared; in 1898 the plot did not commend itself to the stock so much as some of the other plots, so it presented a rougher aspect, though this disappeared in the autumn. In 1899 the stock took to the plot and ate it well down; it was improved in quality and in produce of both grass and clover, but was not equal to the basic slag alone.

The *basic slag* produced an obvious improvement in 1896, and this continued through the following years, so that in 1899 this and the adjoining lime plots were well eaten down by the stock, and presented a very satisfactory improvement.

The *lime* from the beginning showed that a great improvement

in the quality of the herbage had resulted from its application, and the plot has been all through the experiments a favourite one with the stock. It appeared in 1899 to have produced less food than the basic slag plot ; but if it was not equal to that, it was very little behind it.

**13. DURHAM.**—Sheep Pasture, Binchester Whins Farm, Bishop Auckland.

The soil is similar to that of Bell Hills, but of a poorer quality. The field had been in grass for eleven years. Three acres out of 27 were selected for the experiments.

The three plots were treated as follows :—

1. 2 tons of lime.
2. No manure.
3. 8 cwt. of basic slag.

The manures were applied in January, 1896, and the *lime* plot presented a greener aspect than the two other plots in the year it was applied ; in 1897 this was still the most closely eaten down and contained a good deal of clover ; in 1898 the field was hayed and the examination of the standing hay showed that the quantity was considerably increased, though the kinds of grasses were the same as in the rest of the field. Mr Burkitt, under whose management the estate is, estimated that the lime plot would yield 3 cwt. more hay than any acre in the unmanured parts of the field. In 1899, the field being again in pasture had another 2 tons of lime applied, but this did not exhibit any additional improvement, the plot however maintained its superiority over the unmanured plot.

The *basic slag* was not so obvious in its action in the year it was applied as the lime ; but it has since continually improved. White clover made its appearance and was increased in 1897, though in this year the lime plot was better than the basic slag ; in 1898, when the field was hayed, this plot was clearly the most productive, Mr. Burkitt estimating an increase of 6 cwt. in the crop over any unmanured acre in the field ; in 1899 it was by far the best plot in the field.

**14. DURHAM.**—Wilkinson's Land, Binchester Whins Farm, Bishop Auckland.

There is a thin blackish soil at the surface, followed by a mixture of clay and sand and a more sandy subsoil. This is a very poor soil, apparently neglected, with scattered bushes of gorse and white thorn, many weeds and rushes, and having as its principal grasses Twitch and Yorkshire Fog. A shilling an acre would probably have fully represented its value when the experiments began.

The soil proved on analysis to be deficient in lime, potash, and nitrogen, and exceptionally so in phosphoric acid. Six plots of an acre each were selected from the most suitable part of the field, and they were treated as follows :—

1. 6 cwt. of basic slag and 3 cwt. of kainit.
2. 4 cwt. of mineral superphosphate and 3 cwt. of kainit.
3. 4 cwt. of bone meal.
4. 15 loads of dung.

5. 4 tons of lime.

6. 8 cwt. of basic slag.

The upper half of each plot was harrowed and re-seeded. The harrowing and the application of the manures was done in January, 1896, and the re-seeding in March. No new grasses were observed in the upper half of the plots, but the harrowing certainly improved the quality of the pasture, and the half so treated was more closely eaten by the stock.

The *basic slag and kainit* plot did not show any gain from the addition of the 3 cwt. of kainit to the 6 cwt. of basic slag; indeed in 1897 there was very little improvement over the no-manure plot. In 1898 a decided improvement was manifested, and in 1899 it was very nearly as satisfactory as the basic slag plot.

A good deal of clover appeared in the *superphosphate and kainit* plot, and the growth of the grasses was more vigorous in 1898, and this was still better in 1899 when the plot was nearly equal to those on which the basic slag was put.

There was little gain from the *bone meal*, yet through the three years it was obviously better than the unmanured field.

The *dung* plot was the best plot in 1896; it came nigh to basic slag in 1897, and maintained the same position in 1898 and 1899.

The *lime* plot showed a decided gain in 1896, and in 1897 it was closely eaten down by the stock. In 1898 there was a good crop, very palatable to the stock, and this was repeated in 1899.

The *basic slag* showed an improvement in the autumn of 1896; the value of the manures was more obvious in 1897, and especially in this plot, where a vigorous growth with clovers showed itself; in 1898 it held the first place, and in 1899 it easily maintained this position. The remarkable advantage gained by the application of basic slag was so convincing to the farmer that he has applied it to the whole field.

15. YORKSHIRE.—Low Ing, New Hall, Barnsley.

The soil is a clay loam, about 7 inches deep, resting on a greyish clay, and was shown on analysis to be deficient in phosphoric acid. Four acres were selected, and the following treatment was adopted :—

1. Harrowed and re-seeded.

2. 4 cwt. of bone meal.

3. 6 cwt. of basic slag and 2 cwt. of kainit.

4. 4 tons of lime.

The manures were applied in January, 1896. The plot harrowed and re-seeded gained nothing by the new seeds, but the harrowing benefited it by permitting new plants from blown seeds to get to the soil. The field was mown in 1896.

The *bone meal* does not appear to have helped the pasture in any way. In 1899 this plot contained large patches of Twitch untouched by the stock.

The *basic slag and kainit* showed much clover in 1897, and was most thoroughly eaten down by the stock; in 1898 there was a very heavy crop with a thick undergrowth of clover; and in 1899 the

improvement was maintained, though there were throughout the plot patches of Twitch and Yorkshire Fog rejected by the stock.

The *lime* showed itself in the improved pasture in 1897, there being a heavy crop, but as yet little clover; in 1898 the condition of this plot remained the same; the composition of the plot was more irregular in 1899, the stock leaving large patches untouched, and there being still little clover.

**16. YORKSHIRE.**—Long Ing, New Hall, Barnsley.

The soil is a clay loam, and was shown by analysis to be deficient in lime, in phosphoric acid, and in nitrogen. Five plots of one acre each were staked out on this field as follows:—

1. Harrowed and re-seeded.
2. 4 cwt. of bone meal.
3. 6 cwt. of basic slag and 2 cwt. of kainit.
4. 8 cwt. of basic slag.
5. 4 tons of lime.

The manures were applied in January, and the harrowing was done in March and April.

The harrowing improved the plot, but none of the seeds that were sown germinated.

The *bone meal* showed little gain in 1897, but in 1898 it was somewhat better than the rest of the field, and this was still obvious in 1899.

The *basic slag and kainit* considerably improved the plot in 1897; in 1898 there was a large and vigorous growth of grasses and clovers, making it nearly equal to the plot with basic slag alone, and it retained its position in 1899, the basic slag plot alone surpassing it.

The *basic slag* in 1897 was not so good as the last-mentioned plot, but was distinctly better in 1898; it was decidedly the best crop in 1899.

The *lime* made the best appearance in 1897, but it was not so good as, though it was near, the two basic slag plots in 1898; and in 1899, though the yield was not so good as on the plot with the basic slag alone, it was more closely eaten down.

**17. YORKSHIRE.**—Castle Field, near New Hall, Barnsley.

The soil is a clay loam, about 8 inches thick, resting on a clay subsoil. It is a poorer soil than those in the neighbouring fields of Low Ing and Long Ing.

The soil was deficient in lime and nitrogen. Five plots were selected and the following treatment per acre was adopted:—

1. 6 cwt. of basic slag and 2 cwt. of kainit.
2. 4 tons of lime.
3. 8 cwt. of basic slag.
4. 4 cwt. of bone meal.
5. Harrowed and re-sown.

The manures were applied in January, 1896.

The *basic slag and kainit* showed the best results in 1897, and as this plot was next to the untouched field, the contrast was striking. The farmer, Mr. McSparran, estimated the unmanured field as worth 5s. an acre, but this plot he estimated at 20s. In

1898 the basic slag alone and the lime equalled this plot, and these positions were retained in 1899.

The *lime* was not so good as the plots with basic slag in 1897, but it improved so as to be equal to them in 1898, and it maintained this position in 1899.

The *basic slag* in 1897 was not so good as the basic slag and kainit, though it was very nearly equal to it; this position it gained in 1898, and it was looking on the whole the best, though only by very little, in 1899.

The *bone meal* did practically no good in 1897, and in 1898 and 1899 it was very little better than the unmanured portions of the field.

The harrowed and re-sown plot benefited from the harrowing but not from the seeding.

In his answer to inquiries Mr. C. Howard Taylor expresses his conviction that bone meal does very little good to such pastures and is not worth while applying at its price. Basic slag and kainit, basic slag alone, and lime have each been advantageous, relatively in the order given, the benefit being more in the improved quality than in the increased quantity of the herbage. The stock has shown a preference for the plots with basic slag and lime. Mr. Taylor says the experiments have been of great service to himself in his treatment of other pastures, and his neighbours have taken some interest in the experiments and benefited from them.

18. **HEREFORDSHIRE.**—Morton Jeffries, Hereford.

The soil is a firm red loam, resting on a subsoil of red and grey marl.

The analysis showed a deficiency in the soil in respect of phosphoric acid and nitrogen, but there was ample lime and a good proportion of potash. Seven plots were selected and treated per acre as follows :—

1. Seeds scattered over.
2. No manure.
- 3a. 3 cwt. of mineral superphosphate, and 2 cwt. of kainit.
- 8b. 3 cwt. of mineral superphosphate, 2 cwt. of kainit, and 1 cwt. of nitrate of soda.
4. 4 cwt. of dissolved bones.
5. 4 cwt. of bone meal.
6. No manure.
7. 8 cwt. of basic slag.
8. 4 cwt. of mineral superphosphate.

The manures were applied in January, 1896, except the nitrate of soda, which was put on later in the spring.

The seeds never got hold of the soil.

The plot with *superphosphate* and *kainit* was divided into two, and to one half was added some nitrate of soda. Neither section of this plot showed much modification of the pasture in 1896, except that the nitrate of soda somewhat increased the amount. In 1897 the field was hayed, and the produce of this acre plot was 20 cwt., 2 qrs., 1 lb. The heavy crop of hay exhausted the land, and affected

the pasture of the following year, for this was little better than the no-manure plots, and it remained in this position in 1899.

The *dissolved bones* plot was hardly as good as the bone meal plot in 1896, and in 1897 the hay from this plot weighed 18 cwt., 2 qrs., 27 lb. In 1898 this plot was almost on a level with the no-manure plot, and was decidedly poorer than the bone meal.

The *bone meal* has been better than the dissolved bones throughout. There was little show in 1896; in 1897 the hay from this plot weighed 19 cwt., 2 qrs., 16 lb.; in 1898 the pasture was much better than that to which dissolved bones was applied, and in 1899 it maintained this position.

The *basic slag* showed a decided benefit to the pasture in 1896; in 1897 the hay from the plot weighed 23 cwt., 3 qrs., 9 lb.; it was by far the best plot in 1898, and continued so in 1899.

The *mineral superphosphate* showed itself active in 1896, and the hay from the plot in 1897 weighed 20 cwt., 2 qrs., 18 lb. The pasture of 1898 was good, but inferior to the bone meal plot, and this continued in 1899.

There were in the series two no-manure plots. The hay taken from the one in 1897 amounted to 12 cwt., 2 qrs., 1 lb., and from the other 17 cwt., 0 qrs., 13 lb. The plot that had the seed scattered on it yielded 18 cwt., 2 qrs., 27 lb.

19. **HEREFORDSHIRE.**—England's Gate, Field No. 10, Bodenham, Hereford.

The soil is a reddish-brown stiff loam, 7 or 8 inches deep, resting on a red or grey marl. The underlying limestone rock comes often very near to the surface.

The soil has a deficiency of phosphoric acid and of nitrogen, also of vegetable matter, though magnesia is present in considerable quantity. Out of the lower part of the field of 21 acres 6 plots were selected, and were treated per acre as follows:—

1. Seeds scattered over.
2. No manure.
3. 4 cwt. of bone meal.
4. 3 cwt. of mineral superphosphate and 2 cwt. of kainit.
5. 8 cwt. of basic slag.
6. 2 tons of lime.

All the manures were applied in January, 1896. The scattered seeds added nothing to the pasture. The dry years 1896 and 1897 prevented the manures from showing any influence on the herbage. In 1898 the *basic slag* took the lead, but in 1899 it fell behind, looking not much better than the unmanured portion of the field.

The *mineral superphosphate and kainit* plot was very nearly equal to the basic slag one in 1898; but, like the basic slag, it fell behind in 1899, and showed little benefit to the pasture.

The *lime* made only a slight improvement on the no-manure plot in 1898; but at the beginning of 1899 fifteen loads of dung were applied to the plot and consequently increased the vigour of the vegetation and placed it above all the others.

The *bone meal* made little impression on the herbage in 1898,

though the plot was somewhat better than the lime one, but in 1899 it was better than the plots with artificial manures, and came next to the heavily-dunged lime plot.

20. HEREFORDSHIRE.—England's Gate, Field No. 13, Bodenham, Hereford.

The soil is a thin, poor loam, sometimes doing little more than covering the underlying rock.

The soil is deficient in vegetable matter, nitrogen, and phosphoric acid, and is rather poor in lime. Five plots were selected from this field, and were treated per acre as follows :—

1. No manure.
2. 5 cwt. of salt.
3. 4 cwt. of dissolved bones.
4. 8 cwt. of basic slag.
5. 4 tons of lime.

The *salt* has not in any way modified the herbage.

The *basic slag* showed a real gain to the pasture in 1897, which was maintained in 1898, and in 1899 it was decidedly the best plot in the field and was full of clover.

The *dissolved bones* made little change in the pasture in 1897, in 1898 the plot was so much improved that it equalled the basic slag plot, but it fell so low in 1899 that scarcely any improvement could be detected above the no-manure plot.

The *lime* in this field, where the analysis of the soil showed only a small quantity to be present, produced in 1897 a decided improvement, but in 1898 this was not maintained, and in 1899 the plot still further retrograded, moss was increasing, and the plot appeared to be reduced to the condition of the unmanured portion of the field.

In answer to the inquiries addressed to Mr. Arkwright, it is reported that the effect of the different manures has not been obvious, chiefly because of the extraordinary drought of the last four years. In field No. 10 bone meal has done best, if we exclude the produce of the lime plot, which had the farmyard manure applied in 1899. The basic slag has not produced so good an effect in No. 10 field as it has done in No. 13 ; and this success in No. 13 is attributed to the presence of more moisture in the soil. No distinct preference by the stock has been observed for one plot above another. There has been a decided increase of clover in the basic slag plot, and to some extent in the bone meal plot. Basic slag has been in use for several years in the district amongst enterprising farmers on wet clay or retentive soils, and with wonderful effect. Several instances are given of the tested value of basic slag. On Stone Farm, Pencombe, now being worked by Mr. Arkwright, there is a pasture on very high land, about 600 feet above sea-level, which has been in pasture for twenty-two years. In 1885 it was hayed and yielded 6 cartloads per acre on 12 acres. It was hurdled and fed by sheep on cotton cake and home-grown oats and in 1886 the produce amounted to 30 waggon loads per acre. No manure was given to it, and in 1887 it went back to its original state. In 1888

it was dressed with 5 cwt. per acre of basic slag, and in 1889 the heaviest crop ever seen in the district was taken off it, amounting to 31 waggon loads. It is believed that basic slag produces the best results in a damp soil. Where there were dry parts in the field there was no gain.

In another field of 17 acres, 11 acres had 7 cwt. per acre applied in the autumn of 1896. In that year the 11 acres yielded 5 loads of hay. In 1897 the produce rose to 20 loads, and in 1898 to 24 loads. It was grazed in 1899. The cattle and sheep were always on the 11 acres to which the basic slag had been applied. The slag had developed an extraordinary growth of trefoil. The six acres of this field on which no basic slag was used were so bare that the crop was not worth mowing.

21. CAMBRIDGESHIRE.—Crow's Farm, Wilburton, near Ely.

The soil of the selected field is a stiff clay, with so considerable an amount of decayed vegetable matter in the upper layer as to make the soil quite black for 2 inches. This thin surface layer under a hot sun becomes very hard. About 9 inches deep the sub-soil is a heavy yellow clay. The field is water-logged in winter and a dry summer hardens it and burns it up.

The analysis of the soil showed a marked deficiency of phosphoric acid. The organic matter in the soil is abundant, but is unavailable to the plant because, while it is in active life, the surface layer containing this decayed vegetable matter is baked hard. There is plenty of lime and potash.

The field consists of two divisions—one of three acres and the other of five. The three-acre portion was re-seeded, but, owing to the dryness of the season, the seeds did not get a hold of the soil. One half of this re-seeded part was operated upon by a French aerating plough, which opened up the soil a few inches from the surface. The turf was slightly opened by the sharp cutting edge of the strong iron lever which carries the underground plough-point. This operation has not in any way affected the herbage. But, in December, 1898, 12 tons per acre of dung were applied to these two plots, and they have greatly improved with this treatment. In the other division the five plots of one acre each were treated as follows :—

1. 4 tons of lime.
2. 8 cwt. of basic slag.
3. No manure.
4. 6 cwt. of basic slag and 3 cwt. of kainit.
5. 3 cwt. of superphosphate, 2 cwt. of kainit, and 1 cwt. of nitrate of soda.

The manures were applied in April, 1897. Before the end of the year their influence was apparent. The *superphosphate, kainit, and nitrate of soda* application was most speedy in its action, producing a heavy growth of dark-green grasses with a little clover. When the stock was put in the field, this plot was completely eaten down. In the following year, 1898, this plot presented a somewhat poor and starved appearance except near the hedge, where Yellow Oat grass was abundant and vigorous. This was improved in 1899. The

clover was fairly abundant, and the cattle grazed the plot very closely.

The *basic slag* and *kainit* showed some gain in the autumn of 1897; this was maintained and improved in 1898. It was then the best crop on the field, presenting a vigorous growth of white clover and grasses, but in 1899 it lost its pre-eminence, being surpassed by the plots manured with superphosphate and basic slag.

The *basic slag* gave no indication of benefit in the autumn of 1897. In 1898 there was a very decided improvement, though the plot was not equal to that in which *kainit* was added to the basic slag. In 1899 the appearance was much improved, a considerable amount of clover was present, and it took its place alongside the superphosphate plot.

The *lime* showed no influence in the autumn of 1897. Some clover appeared in 1898, but it was little better than the no-manure plot, and this was its position in 1899. Mr. Pell reports that the lime has done no good.

He further reports that the stock feed best and most frequently on the basic slag and superphosphate plots. The influence of the nitrate of soda on the superphosphate plot appears to him to be becoming exhausted. The great value of basic slag for improving poor pastures and promoting the growth of clover is, in Mr. Pell's opinion, an important outcome of these experiments. No neighbour has taken the smallest interest in the experiments.

## 22. ESSEX.—Hatfield Peverel, Fairstead.

The soil of this experimental field is a heavy clay with a stiffer clay subsoil. It has been a long time in grass, but the herbage was thin and poor. It had been grazed by dairy cows, and an occasional dressing of dung had been given it.

The soil is deficient in lime and potash, has a moderate supply of phosphoric acid, and a fair amount of nitrogen. The following manures were applied per acre in April, 1897, when the experiments in this locality were instituted :—

1. 8 cwt. of basic slag.
2. 3 cwt. of superphosphate, 2 cwt. of *kainit*, 1 cwt. of nitrate of soda.
3. 4 tons of lime.
4. No manure.

A portion of the end of each plot had some seeds sown on it, two of the portions having Cock's-foot and the other two Timothy; but here, as elsewhere, the seeds were unable on account of the heat to push their roots into the ground, and the germinating plants perished.

In the autumn of 1897 a marked improvement was seen in the greenness of the herbage, and in the greater liking the cows had for the three plots.

The *basic slag* showed best in 1897 and maintained its position in 1898 and 1899.

The *superphosphate*, *kainit*, and *nitrate of soda* plot was nearly equal to the basic slag one in 1897, the nitrate of soda having given a

vigorous start to the herbage, and the heavy growth, though eaten by the stock, was not so completely eaten down as on the lime and basic slag plots. This vigour has continued through 1898 and 1899. The Hon. Edward G. Strutt considers that the basic slag and the superphosphate, kainit, and nitrate of soda have produced satisfactory results, and that the basic slag plot is preferred by the stock.

The *lime* has made the pasture more palatable to the cows; but it has made little other apparent improvement. This has been the condition of this plot throughout the three years of the experiments. Mr. Strutt reports that there is certainly more clover in the basic-slag plot, and to a lesser degree in the superphosphate plot. The "hardhack" has been killed in the three plots. There is no indication of the two successful manures being yet exhausted. Mr. Strutt has used basic slag more generally for grass lands in consequence of these experiments, but he has not seen the satisfactory results in other fields which are manifest in the experimental plot. The neighbours have taken little or no interest in the experiments, and have made no practical use of them.

#### SUMMARY.

Of the experiments generally it may be said that in the majority of cases it has been shown that improvement, and occasionally great improvement, can be effected on poor pasture land by a judicious system of manuring, and that results have been obtained undoubtedly of value, not only to the particular land experimented upon, but also to the district around.

Thus, out of eighteen localities where the experiments were completed, in twelve cases there was a satisfactory result, and in seven of these the benefit was very marked. The seven localities were No. 4 Tatton, No. 6 Limber, Brocklesby; Nos. 12, 13, and 14 Bishop Auckland; No. 17 Barnsley (Castle Field), and No. 21 Wilburton, Ely. In the other six instances, improvement was of a doubtful or negative character.

That local interest has not been more aroused, even where a marked improvement has been obtained, is to be regretted, though this is not exceptional in the pursuit of experimental inquiry. Here and there, on the other hand, a good deal of local interest has been evinced, and the knowledge that these experiments were carried out under proper supervision and with efficient local control, no doubt added to the value put upon them.

Another feature brought out is the marked correspondence between the forecast given by the chemical analysis of the soil and what was actually found in practice to be useful on the field. The soils were all analysed in the first instance. Their deficiencies and sufficiencies were noted, and the treatment of the different plots was fixed in regard to these.

In every one of the ten cases (out of a total of eighteen) in which analysis showed a deficiency of phosphoric acid in the soil, *basic*

*slag* or else *superphosphate* (which are essentially phosphoric-acid-containing manures) was found to be valuable in practice.

The cases in which the application of *lime* benefited the pastures were, with one exception, all indicated beforehand by the analysis of the soil showing a deficiency of lime; and, similarly, where lime was found to be abundant in the soil, no effect was derived from its further use. A somewhat similar correspondence has been found in the case of nitrogen when lacking, but that with potash, though tried to a more limited extent, has not been marked.

In regard to mechanical means of improving the pastures, *harrowing* of the land, where the cost has not exceeded 10s. an acre, has been found useful. Re-seeding, or "renovating," as it is termed, has not been successful. This has been entirely due to the prevalence of dry seasons, the germinating plants being killed before they could get hold of the soil.

The changes in the botanical composition of the pastures have been of a limited nature, and have been confined mainly to the increase of clover following the application of basic slag or of lime. Unpalatable grasses, like *Twitch*, have been made more palatable, chiefly by the use of these same two materials, lime and basic slag; and moss, too, has been driven out in places. But, with the above exceptions, there has been little modification in the essential constituents of the pastures.

The effect of the application of *salt* on pastures was tested in three localities (Buckinghamshire, Northamptonshire, and Herefordshire). The testimony from these three places is uniform. The salt produced no change in the quality of the pasture, and did not make the herbage more palatable to stock.

*Bone manure* was tried in ten localities (Hampshire, Lincolnshire, Durham, Yorkshire, and Herefordshire). In Herefordshire some benefit was observed, but in the other places no real improvement could be detected as compared with the unmanured part of the field.

So far as these investigations go, therefore, they indicate that no further experiments need be made with salt or bones on pasture land.

Experiments with *basic slag* have been carried on in seventeen localities (Hampshire, Buckinghamshire, Essex, Cambridgeshire, Northamptonshire, Lincolnshire, Durham, Yorkshire, Cheshire, and Herefordshire). These give a fairly uniform testimony as to the value of this material as a manure. The basic slag alone gave scarcely any result the first year (1896). The autumn and spring rains made the slag available for the vegetation in 1897, and in that and the two following years it produced a uniformly excellent crop, or a gradually improving one. There is no evidence that the influence of the basic slag is decreasing. In six additional plots in certain of the same localities, *kainit* was added to the basic slag, and the results showed that the quantity and quality of the crop in these six plots were, throughout the three years, improving, though at no time did the yield equal that from the basic slag alone.

DIAGRAM SHOWING THE EFFECT OF THE MANURES ON THE PASTURES THROUGHOUT THE FOUR YEARS DURING WHICH THE EXPERIMENTS HAVE BEEN CARRIED ON.

The numbers on the left-hand column of each series refer to the serial number in the Report. The base line in each experiment represents the condition of the pasture before the experiments began; and the short lines above it indicate the improvement in different years, this being greater or less as the short lines are farther from, or nearer to, the base line. Where no improvement resulted, as in the cases of the application of salt and of bone manures, the lines are close to the base line. The high, or ascending, lines of the experiments with basic slag and lime show their value. The initial high lines of the mineral superphosphate tell of the speedy use of this manure by the plant, while their subsequent approach to the base line manifests its decreasing influence on the herbage. The farm-yard manure is more irregular in its action, but it generally agrees with that of the superphosphate.

SALT	BASIC SLAG				BASIC SLAG AND KAINIT				LIME				MINERAL SUPERPHOSPHATE KAINIT AND NITRATE OF SODA				FARM YARD MANURE	
	1896	1897	1898	1899	1896	1897	1898	1899	1896	1897	1898	1899	1896	1897	1898	1899		
7	4	—	—	—	7	—	—	—	4	—	—	—	—	—	—	—	—	
9	6	—	—	—	12	—	—	—	5	—	—	—	—	—	—	—	—	
20	7	—	—	—	14	—	—	—	10	—	—	—	—	—	—	—	—	
BONE MANURE	8	—	—	—	16	—	—	—	11	—	—	—	—	—	—	—	—	
	9	—	—	—	17	—	—	—	12	—	—	—	—	—	—	—	—	
	10	—	—	—	21	—	—	—	13	—	—	—	—	—	—	—	—	
	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	



It is evident that basic slag is a very valuable manure for pastures, and that its partial replacement by kainit is not generally to the advantage of the cultivator.

*Mineral superphosphate* was applied in two localities (Northamptonshire and Herefordshire). This produced a very considerable gain in 1897, but the benefits diminished during the two following years. *Kainit* in addition to superphosphate was used in six places (Hampshire, Buckinghamshire, Lincolnshire, Cheshire, and Herefordshire). The results practically agreed with those observed on the plots which had superphosphate alone. The addition of *nitrate of soda* to the superphosphate and kainit produced a heavy crop in 1897, a poor one in 1898, and a somewhat better one in 1899 in Cambridgeshire, while in Essex the crop was very good in all the three years. The experiments show clearly that superphosphate quickly helps the herbage, but that its influence is not long-continued.

*Lime* was applied in fourteen localities (Hampshire, Buckinghamshire, Essex, Cambridgeshire, Durham, Yorkshire, Cheshire, and Herefordshire). It has throughout improved the pastures, and maintained the improvement, except in two places which suffered from severe drought. In some instances the lime has rivalled the basic slag in its beneficial influence ; but generally, though the improvement has been everywhere very marked, it has not equalled the results obtained by the basic slag.

*Dung* was applied in eight localities (Hampshire, Buckinghamshire, Northamptonshire, Lincolnshire, and Durham). In all these places the manure benefited the pastures ; but after producing one heavy crop, which was as a rule rejected by the stock, because of the presence of the manure, the improvement fell off, and in some cases very considerably before the end of 1899.

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## Notes, Communications, and Reviews.

### THE WINTER OF 1899-1900.

HAD there been no other depressing influences abroad, the weather of last winter would in itself have been enough to damp the spirits of the cheeriest. Other seasons within memory have been more severe, and some far more violent as regards storms of wind and snow, but few have been marked by so monotonous a run of raw damp weather, unrelieved for the most part by any events of striking meteorological interest. For days, and almost for weeks together, the thermometer hovered a few degrees above the freezing-point, a state of things attended, in this as in most other instances, by a humid atmosphere, and a feeling of discomfort greater than is experienced with a colder but drier air. The effect of so much disagreeable weather was shown in several ways. The public health was, in the first place, seriously affected, more particularly in the early part of the year, when influenza put in what may now be regarded as almost an annual appearance. The farmer had also to complain of late frosts, followed by heavy snows and rains, which left the soil in so water-logged a condition that all work was brought for a time to a complete standstill. The skater even was not satisfied, for the two spells of severe frost which occurred were all too short to permit of the formation of good serviceable ice on any but the shallower waters, and even there it thawed almost as soon as sport had really commenced.

The winter began with a week or so of mild changeable weather, with light breezes mostly from south or south-west. Towards the middle of December the wind became more variable, and a very sharp frost set in, with occasional falls of snow in most parts of the country. After the 17th or 18th the cold became less intense, but for the remainder of the month the thermometer was usually a little below the average, the weather being very changeable, with strong gales from the eastward or south-eastward on the 28th, and snowstorms, followed by considerable falls of rain. In January the weather was, as a rule, fairly quiet, the wind being mostly from points between south and west, and temperature a little above the average. Heavy rains fell in many places in the earlier part of the month, and snow in the concluding fortnight, but the latter came mostly in the form of showers, and did not remain long upon the ground. February proved by far the most violent, and in some

respects the most wintry, month of the three. The winds were at first from the north-eastward, and the weather was dull and cold, with occasional snow showers. Later on several important cyclonic systems advanced over the United Kingdom from the south-westward, and gales from various directions were experienced very generally with severe snowstorms in nearly all parts of the country. In the south the heaviest snows were those of the 2nd, the 10th, and the 13th, the amount being on each occasion larger than that experienced in any recent winter. In its effects, however, the most serious atmospherical disturbance was undoubtedly that of the 15th. On that day the centre of a deep barometrical depression moved northwards across Ireland and the west of Scotland, the disturbance occasioning slight southerly gales and heavy rains in the southern districts, but violent south-easterly gales and severe snowstorms in all the more northern parts of the Kingdom. On land the results of these heavy winds and snows were seen in a widespread breakdown of the telegraph wires, while at sea they were shown still more seriously in a numerous list of casualties, resulting in many cases in considerable loss of life. After the disappearance of the deep depression of the 15th the weather became somewhat quieter, but at the same time it remained very unsettled, with frequent falls of rain or snow, no decided improvement occurring until the opening days of March. In many parts of the midland and western counties the rapid melting of the snow after the middle of February, and the subsequent heavy rains, caused serious floods, large areas of land being entirely under water.

The leading features in the weather of the entire season are shown in a statistical form on p. 141, the following remarks giving further details of interest in connection with the history of each particular element.

*Temperature.*—The mean temperature was above the average in the first week of December, but below it for the rest of the month, the week ending on the 16th being in most places the coldest of the whole winter. In January the thermometer was almost continuously above the average, and in the fourth week the excess of heat was large. In February the first three weeks were cold, and the second and third unusually so, the week ending on February 10 being in some of the southern districts colder even than the second week in December. Taking the winter as a whole the mean temperature was below the average in all districts excepting the Channel Islands, the deficit being greatest in the north-western, but large also in the north-eastern and midland counties. In the east and south the deficit was small, while in the Channel Islands the mean temperature was slightly above the average. Over the northern, eastern, and southern parts of the country the deficiency of heat seems to have been distributed with fair impartiality over the whole twenty-four hours, but in the midlands the days were relatively much colder than the nights, while in the south-west the reverse was the case. In the Channel Islands the excess of warmth occurred mostly in the daytime. A comparison with previous winters shows that over the

**Temperature, Rainfall, and Bright Sunshine experienced over England and Wales during the Thirteen Weeks ended March 3, 1900.**

(The Winter Season.)

Districts	TEMPERATURE							
	High- est ob- serv- ed	Low- est ob- serv- ed	Day temperatures		Night temperatures		Day and night temperatures combined	
			Mean	Differ- ence from average	Mean	Differ- ence from average	Mean	Differ- ence from average
North-eastern counties . . .	56	15	41·2	-1·3	32·1	-1·5	36·7	-1·4
Eastern counties . . .	60	8	42·3	-0·5	32·1	-0·3	37·2	-0·4
Midland „ . . .	59	5	41·6	-1·6	31·6	-0·8	36·6	-1·2
Southern „ . . .	58	18	44·0	-0·3	34·2	-0·3	39·1	-0·3
North-western counties, in- cluding North Wales .	57	8	42·1	-1·9	33·5	-1·7	37·8	-1·8
South-western counties, in- cluding South Wales .	57	10	45·4	-0·4	35·8	-0·9	40·6	-0·7
Channel Islands . . .	58	24	48·9	+1·0	41·1	+0·3	45·0	+0·6

Districts	RAINFALL				BRIGHT SUNSHINE			
	Days with rain		Total fall		Duration		Percentage of possible amount	
	Num- ber	Differ- ence from average	Am- ount	Propor- tion of average amount	Hours re- cord- ed	Differ- ence from average	Per- cent- age	Differ- ence from average per- centage
North-eastern counties . . .	60	+12	ins. 9·6	156	129	-16	17	-3
Eastern counties . . .	61	+13	8·3	139	163	-18	21	-2
Midland „ . . .	56	+10	9·9	145	130	-15	17	-2
Southern „ . . .	58	+12	10·0	133	164	-17	21	-2
North-western counties, including North Wales }	57	+6	11·5	130	149	+2	20	+1
South-western counties, including South Wales }	64	+11	15·8	135	183	-6	23	-1
Channel Islands . . .	72	+13	15·2	154	180	-40	22	-5

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office. The averages employed are: For Temperature, the records made during the twenty-five years, 1871-95; for Rainy Days, the values for the fifteen years, 1881-95; for Total Rainfall, those for the thirty years, 1868-98; and for Bright Sunshine, those for the fifteen years, 1881-95.

country generally the past season was the coldest since that of 1894-95, but in the Channel Islands it was a trifle milder than that of 1896-97. The highest temperatures of last winter were recorded as a rule on February 23 or 24, when the thermometer exceeded 55° over the country generally, and reached 60° at Geldeston (near Beccles). In some places, however, the thermometer was equally high, and at isolated stations in the west even a degree or two higher, at the beginning of December. The absolute maxima were in all cases lower than those registered in the winter of 1898-99, but with that exception they compared favourably with those of most recent seasons. The lowest temperatures of last winter occurred as a rule between December 14 and 16, when the sheltered thermometer fell below 20° in all inland parts of the country, and below 10° at several of the more central stations. At places reporting to the Meteorological Office, and from which the figures in the table are exclusively derived, the lowest readings were 5° at Hereford, and 8° at Geldeston and Loughborough. From information given, however, in "Symons's Meteorological Magazine" for January 1900, it is quite clear that in some other parts of the country the cold was even more severe. At Goldsborough Hall, York, and at Leominster, a reading of 4° was registered, and at Compton (Berks) and Abergwesyn (Brecon) one of 3°, while at Clunbury (Shropshire) the thermometer fell to zero. On the ground the readings were of course still lower, and at Worksop (Hodsock Priory) an exposed thermometer fell to as much as 7° below zero. During the second spell of frost, occurring between February 8 and 14, the sheltered thermometer again fell below 15° in many parts of the country, the lowest readings reported to the Meteorological Office being 8° at Newton Reigny (near Penrith), and 10° at Rothamsted (Herts) and Llandovery (Carmarthenshire). On each occasion, i.e. both in December and February, the frost was more intense than anything experienced in the four preceding winters, but not nearly so severe as that of February 1895. With the exception just mentioned, the frost of last February was the sharpest experienced at so late a period in the season for very many years past. In January there was an entire absence of severe weather, the lowest readings observed being not more than 9° or 10° below the freezing-point.

*Rainfall.*—The last week in December and the first week in January were extremely wet, as also were the third and fourth weeks in February. At other times the rainfall was mostly short of the average, but with the exception of the second and third weeks in December the deficiency was not general, some portions of the country having more than their normal allowance. Taking the winter as a whole, the amount of rain was largely in excess of the average. In every other district but the north-western the excess amounted to at least one-third of the normal, the wettest parts, relatively speaking, being the two widely separated districts, the north-eastern and the Channel Islands. In the former the amount of rain was 56 per cent. and in the latter 54 per cent. more than

the average. In our south-western counties the winter was not so wet as its immediate predecessor, that of 1898-99, and in the north-west it was somewhat drier than in 1897-98, but in all other parts of the country it was the wettest experienced for very many years past. At some places in the east and south of England there had in fact not been so wet a winter since that of 1882-83, while at several of the more central stations, including London, it was certainly the wettest since that of 1876-77. The rainy character of last winter is shown not only by the total amount recorded, but also by the very large number of days on which rain fell. In an average winter the number of wet days ranges between 46 and 48 in all the eastern and central parts of the country to a little above 50 in the western districts, and to very nearly 60 in the Channel Islands. Last winter the number was nowhere as low as 55; in the north-eastern, eastern, and south-western counties it was at least 60, while in the Channel Islands it was as high as 72. In so wet a season there were naturally many instances of heavy individual falls. The principal cases occurred (1) on December 28 and 29 in all the western districts, the total amount for the two days being over an inch and a half in many places, and as much as 1·9 inch at Cul-lompton (mid-Devon), and 1·8 inch at Arlington (north Devon); (2) on January 6, when over an inch fell in many parts of England and Wales, 1·5 inch at Liverpool, and 2·8 inches at St. Mary's, Scilly; (3) on February 14 in the south-west of England, and on the following day, over the southern districts generally, the amount in twenty-four hours again exceeding an inch in several places, and reaching 1·4 inch at Arlington; (4) on February 26 and 27, in the north and north-east of England, the total amount for the two days being as large as 1·8 inch at Alnwick Castle, and 1·7 inch at Durham and Scarborough. Snow was more frequent than in most recent winters, the chief falls occurring between December 8 and 14 and December 22 and 28, between January 27 and February 6, and between February 9 and 16. The heaviest snowstorms were those of February 2 (in the south and east of England), of February 10 (a very general fall), of February 13 (heaviest in the south), and of February 15 (very heavy in the north). Thunder and lightning occurred on several occasions on our south-west coasts, but scarcely ever penetrated further inland.

*Bright Sunshine.*—The duration of bright sunshine was in excess of the average in the last week in December, the second week in January, and the second and third weeks in February. At most other times the amount was less than the normal, the duller weeks being the third in December, and the first and last weeks in February. Taking the season as a whole, the amount of sunshine was deficient in all but the north western district, where the amount corresponded very closely with the average. In most other districts the deficiency was comparatively slight, the duller region of all being the Channel Islands, where the mean daily amount for the whole winter was only two hours, as against an average of nearly two hours and a half. The large deficiency in this neighbour-

hood seems rather remarkable, when we consider that it was in the Channel Islands alone that the mean temperature of the winter showed any excess above the average.

## INDEX NUMBERS OF THE PRICES OF COMMODITIES IN 1899.

THE subjoined letter, written by Mr. A. Sauerbeck, appeared in "The Times" of January 13, 1900. The term "index number" was defined in the Journal in 1893.<sup>1</sup> The Journal for 1899 (3rd series, vol. x. Part i. p. 186) contains the index numbers for 1898.

"The following are the average index numbers of the prices of 45 commodities, the average of the 11 years 1867-77 being 100 :—

AVERAGE.					
1878-87 . . .	79	1880 . . . . .	72	1895 . . . . .	62
1880-98 . . .	68	1890 . . . . .	72	1896 . . . . .	61
	—	1891 . . . . .	72	1897 . . . . .	62
1880 . . . . .	88	1892 . . . . .	68	1898 . . . . .	64
1887 . . . . .	68	1893 . . . . .	68	1899 . . . . .	68
1888 . . . . .	70	1894 . . . . .	63		

"The index number for last year is four points (or 6½ per cent.) higher than in the preceding year, but the advance as compared with the lowest year on record—1896—amounts to seven points (or 11½ per cent.). It is still 32 per cent. below the standard period, which was equivalent to the average of the 25 years 1853-77. The rise is smaller than was probably expected by many observers, and this is explained by the fact that the average advance for the whole year applies only to materials, and here principally to minerals, to a smaller extent to textiles, and to a very slight extent to sundry materials. Articles of food, on the other hand, were in the aggregate lower—an advantage, no doubt, to consumers—and were exactly on a level with 1897, so that the advance obtained in 1898 was again lost.

"The monthly fluctuations were thus :—

1889 December	73·7	1896 July . . .	50·2	1899 May . . .	66·6
1890 "	71·1	1896 December	62·0	1899 June . . .	66·9
1891 "	71·4	1897 "	62·4	1899 July . . .	67·6
1892 "	67·7	1898 "	63·8	1899 August . .	68·3
1893 "	67·0	1899 January	65·4	1899 September	70·0
1894 "	60·1	1899 February	65·8	1899 October . .	71·5
1895 February	60·0	1899 March . .	65·6	1899 November	71·6
1895 December	61·2	1899 April . . .	66·1	1899 December	72·3

"The index number at the end of the year was 13 per cent. higher than at the end of 1898. The principal changes in Decem-

<sup>1</sup> See *Prices of Commodities during the last Seven Years (1886-92)*. Journal R.A.S.E., 3rd series, vol. iv. 1893, pp. 394-404.

ber were—metals, cheaper ; meat, butter, coals, flax, hemp, wool, dearer.

“Taking articles of food and materials separately, the index numbers compare thus (1867-77=100) :—

	1878-87 Average	1889-98 Average	1889 Dec.	1895 Feb.	1896 July	1898 Dec.	1899 Nov.	1899 Dec.
Food	84	69	73.1	63.8	60.0	65.6	64.4	65.1
Materials	78	64	74.2	57.0	58.6	62.4	76.8	77.5

“Articles of food are now nearly 1 per cent. lower, but materials 24 per cent. higher than a year ago, while the rise for materials from the lowest point in February 1895 amounts to as much as 36 per cent. in the aggregate.

“The position of the six separate groups of commodities at the end of the last two years in comparison with former periods is illustrated by the following index numbers (1867-77=100) :—

—	1878-87 Average	1889-98 Average	Dec. 1898.	Dec. 1899.	Last year. Per cent.
Vegetable food (corn &c.)	79	62	62.4	58.7	fall 6
Animal food (meat and butter)	95	80	76.9	78.9	rise 3
Sugar, coffee, and tea	76	65	52.5	53.7	„ 2
Minerals	73	69	75.7	98.3	„ 30
Textiles	71	57	49.9	71.2	„ 43
Sundry materials	81	66	63.1	68.8	„ 9

“In this comparison it must be remembered that minerals had already an advance of 14 per cent. in the year 1898, against only 3 per cent. for textiles.

“In the course of last year prices of corn remained generally on a low level, with but moderate fluctuations. Meat and butter were somewhat dearer, the latter being affected by the drought. Sugar and the common sorts of tea ruled a little higher than in the preceding year, though both articles are still on a very low basis ; while Brazil coffee was lower than ever before, Santos touching 25s. per cwt. Metals generally reached their highest points between July and October, but gave way to some extent later on, while coals obtained almost famine prices at the end of the year. The highest price for iron last year—75s. 7d. per ton for Scotch—has not been known since 1874, and that for spelter since 1873 ; but copper and tin, although very dear, were still higher during the speculation in 1887-88. Among textiles we have to record an advance for cotton in view of a large consumption and lower estimates of the current crop, but prices are still exceedingly low as compared with former periods. Flax touched the lowest price on record, improved gradually, and realised a sharp advance in December. Manila hemp experienced great fluctuations in conjunction with the policy of opening and again closing the port ; the price

was 17*l.* per ton at the end of 1897, 24*l.* 10*s.* in 1898, and about 64*l.* at the end of last year—probably the highest figure on record, certainly since 1866. Merino wool, the production of which has been declining for some years owing to a change in breeding and to five years of drought in Australia with great mortality of sheep, advanced over 60 per cent., and has not been so high since 1880; while the bulk of coarse wools occupied the lowest level on record for the greater part of the year, and only improved to some extent towards the end. Silk was considerably higher. Among sundry materials, hides, tallow, petroleum, various oils, and indigo advanced to some extent.

"The average price of silver was 27  $\frac{7}{8}$ *d.* per oz., against 26  $\frac{1}{8}$ *d.* in 1898. It stood at 27  $\frac{5}{8}$ *d.* at the end of 1898, and, with the exception of a moderate speculative movement in April and May, the metal remained remarkably steady, and closed at 27  $\frac{3}{8}$ *d.* The shipments to India and China were large, and Russia purchased also a larger quantity than in the previous year. The index numbers were as follows (60·84*d.* per oz. being the parity of 15½ to 1 gold = 100) :—

Average 1898	:	:	:	44·3	End of 1898	:	:	:	44·9
" 1899	:	:	:	45·1	" 1899	:	:	:	44·7

"The production of gold in 1899 was probably very much the same as in 1898—viz. 60,000,000*l.*—any decline in South Africa owing to the war having been made up by an increase in Australia and North America. In 1898 the United States alone, according to their official returns, retained about 41,000,000*l.*, and in 1899 up to November 1 about 13,000,000*l.* Nearly 6,000,000*l.* in sovereigns had to be forwarded to South Africa last year, and nearly 5,000,000*l.* were acquired by the Indian Treasury, while a strong demand for gold for Argentina set in towards the end of the year to pay for the increased value of the wool clip.

"The past year will on the whole be considered a very prosperous one, and the activity of the manufacturing industries in Europe, as well as in America, was greater than at any time since 1871–73, the period after the Franco-German war. It is true that one great industry—agriculture—was not prosperous, particularly in this country, as prices were low for corn, moderate for meat, and very depressed for the greater part of the year for domestic wool. But the harvest was fairly good, and as the year 1898 had been a very profitable one a balance had probably been carried over to make good any shortcomings. The manufacturing industries, on the other hand, were exceedingly busy and very prosperous in nearly all branches—engineering, shipbuilding, the cotton, woollen, linen, and silk industries. The working classes were fully employed, and had the great advantage of higher wages, combined with low prices for food. Company promotion and new issues of capital were still on a large scale, though there appeared to be some falling-off in the second half of the year. The war in South Africa has not had an unfavourable effect on trade so far, but its influence on the gold

supply has contributed to make the money market still tighter in conjunction with the great internal trade demands in Europe and the absorption of gold by the United States, India, and Argentina already mentioned. No doubt speculation has contributed to the rise of some articles, particularly some of the metals; but most of the development appears to have been thoroughly sound, and the prospects for the present year are generally held to be favourable."

From the subjoined letter, which the same writer published in "The Times" of March 10, 1900, it will be seen that the index number advanced to 74 in January, and to 75·1 in February.

"The following are the index numbers of the prices of 45 commodities, the average of the 11 years 1867-77 being 100 :—

AVERAGE.					MONTHLY NUMBERS.				
1878-87	.	.	.	79	1889 December	.	.	73·7	
1880-89	.	.	.	76	1895 February	.	.	60·0	
1890-99	.	.	.	66	1896 July	.	.	59·2	
1889	.	.	.	72	1899 February	.	.	65·8	
1893	.	.	.	68	1899 September	.	.	70·0	
1896	.	.	.	61	1899 December	.	.	72·3	
1897	.	.	.	62	1900 January	.	.	74·0	
1898	.	.	.	64	1900 February	.	.	75·1	
1899	.	.	.	68					

"There is a fresh advance in the index number, to which various commodities have contributed. Several articles of food have been slightly dearer; iron experienced very little change, but copper, tin, and the average export price of coals were again higher. The London wholesale price of house coals, on the other hand, was reduced from 27*s.* to 22*s.* Among textiles there was an advance for cotton and flax, but merino wool was weaker and has since suffered a distinct fall. Several kinds of oil ruled somewhat higher.

"Taking articles of food and materials separately, the index numbers compare thus (1867-77=100) :—

	1878-87 Average	1890-99 Average	1889 Dec.	1895 Feb.	1896 July	1899 Dec.	1900 Jan.	1900 Feb.
Food	84	68	73·1	63·8	60·0	65·1	65·0	65·8
Materials	76	64	74·2	57·0	58·6	77·5	80·5	81·9

"The prices and index numbers of silver were as follows (60·84*d.* per ounce, being the parity of 1 gold to 15½ silver=100) :—

	Price	Index No.
End August, 1897	23½	39·2
„ December, 1899	27½	44·7
„ January, 1900	27½	45·5
„ February, 1900	27½	45·2

## SELECTION AND ITS EFFECTS ON CULTIVATED PLANTS.<sup>1</sup>

THE word *selection*, taken in its general sense, means *choice*. In natural history, when applied to plants or animals which man raises under domestication, it assumes a more restricted meaning, and is applied only to the choice of individuals considered as agents of reproduction. It is in this sense alone that the word *selection* is used in this article.

The purpose of this paper is to indicate the reasons for making a certain choice, the results it may produce, the precautions that should accompany it, the practical methods of applying it, and the difficulties that may be met and may defeat the purposes in view.

Evidently the process is quite different from natural selection. The latter proceeds independently of man by the simple interplay of natural forces, while artificial selection is an act performed by man for the purpose of satisfying his needs and tastes. Nature modifies plants in *their* interest ; man modifies them in *his* ; but in the one case, as in the other, there is an acquirement of characters and a transmission of the characters acquired.

This article is not the proper place to discuss selection and its relation to evolution, of which the creation of varieties by selection is only one phase ; nor is it the place to discuss the relative permanence of existing species. The task of the improver of cultivated plants is not to create new species, but to establish and fix in known species well-defined and constant races possessing distinct characters which may render them useful or agreeable to man.

The practice of selection is almost or quite as old as the practice of cultivation itself. It is certain that from the most remote beginnings of pastoral life primitive man has preferred the finest and best-shaped animals for breeding purposes. In the same way, when the culture of certain useful plants had succeeded to a more primitive form of pastoral agriculture, or had become associated with it, the domesticated races of plants were gradually ameliorated by the diligence of some men who were more observant and interested than others ; and the improved races were disseminated from place to place.

### THE EFFECTS OF CULTIVATION ON PLANTS.

Much has been said of cultivation as a means of improving plants. The writer believes, however, that the selection of the individual intended to reproduce a sort has done infinitely more in this direction than cultivation properly so called. Without doubt, the larger amounts of plant food, air, and room that are provided for the plant under careful cultivation, as compared with wild con-

<sup>1</sup> From a paper by the late Monsieur Henry L. de Vilmorin in the *Experiment Station Record*, vol. xi. No. 1. U.S. Department of Agriculture.

ditions, are the means by which some given plants attain to a greater individual development ; but cultivation in general advances improvement principally because it gives to man an opportunity to observe the plant closely, to notice even the slightest variations in the characters of the different individuals, to note at the time of their occurrence all the variations which appear useful to him, and to fix them by sowing the seed from all the individuals that have shown these variations.

Superabundance of food supply undoubtedly favours the appearance, in cultivated plants, of variations which consist of multiplication of parts of a plant or the excessive development of certain parts among them ; but heredity interferes to fix these characters, so that they are seen to persist in individuals escaped from cultivation and are perpetuated for a long time, even after the causes that brought them into existence have ceased to act.

#### SELECTION IN THE EARLIER AGES.

We possess few records bearing on the history of the improvement by selection of the various useful or ornamental plants in ancient times ; yet the figures which have been left to us in paintings, mosaics, and sculptures indicate a notable improvement of the species cultivated by the Egyptians, the ancient Greeks, and the Romans, over the wild types of the same plants found in those regions at the present day. The leeks of Egypt, to the fame of which the sacred writings bear witness, are represented on the bas-reliefs and paintings of Egyptian tombs as of a size far superior to that of the wild leeks of the mountains of Central Asia, which, without doubt, represent the primitive type of the species. The Romans cultivated several varieties of *Brassica oleracea* that represented an immense advance over the wild type found on the coast regions of Europe. The flowers and fruits, figures of which are found frequently in Roman works of art, resemble more the varieties of the present day than the primitive types from which they were developed.

In passing it may be remarked, in reference to those fruits and flowers that are propagated by grafts and not by seeds, that selection is not entirely unconcerned in their culture, but even in such cases is found to exert its influence in several ways. A new variety generally originates from a seed which may have been accidentally planted, the resulting plant being reproduced and multiplied by grafting, or from seed planted by man, the various young plants being carefully observed from day to day and compared with each other, and meritorious novelties, if such appear, selected and propagated. In grafting, two things must be taken into consideration : In the first place, only those stocks should be used that are healthy, vigorous, as free as possible from defects and diseases, and well provided with roots ; and, in the second place, the grafts should be taken from the youngest and healthiest shoots of the plant that is to be propagated, and always from those that represent most faithfully

the characters it is desired to reproduce. Sometimes variations are produced in plants by dimorphism, as by variation in the form or colour of the foliage or in the shape or hue of the flowers, as often occurs in the chrysanthemum. There is then opportunity for the selection of the modified branch, which is propagated by cuttings or any other method. The question of the permanence or running out of varieties of fruit trees, which is so often and so contradictorily discussed in the horticultural press of all countries, is intimately connected with this question of selection. There is no reason why a given type should run out if only proper stocks and healthy grafts are used in propagation, but the variety will certainly disappear if it is attacked by parasites to the extent that it is no longer possible to find a graft that does not carry with it its enemy.

To return to the history of selection of cultivated vegetables and flowers propagated by seeds. Italy, Provence, Flanders, and the neighbourhood of Paris were, at about the beginning of modern times, the principal centres of the improvement of common plants. Seeds grown in these places bore a high reputation throughout Europe, and the popularity that they enjoyed shows that the characteristics developed in the different varieties of plants by these skilful and careful gardeners were well fixed, else they could not have reproduced themselves faithfully when cultivated under very different conditions of soil and climate. Vegetable gardeners have been for the most part the creators of European varieties of vegetables (and at the same time of many varieties of flowers, for the two occupations of vegetable gardener and florist were very often followed by the same individual, as is frequently the case at the present day), and the uniformity, the constancy, and the cooking qualities of the varieties of vegetables originating in Naples, Milan, Lyons, Paris, and the Low Countries bore witness to the skill, fine observation, and judgment in the application of selection which our predecessors possessed.

It is only since the latter half of the seventeenth century that the seed business has begun to be separated, little by little, from that of general gardening, and, as division of labour always results in an improved product, the establishments that have devoted themselves exclusively to the growing of seed have come to do it better and more economically than the common gardeners, whose time and effort were divided among various lines of production. In one respect, however, the competition of the market gardeners, as well as that of the florists properly so called, is still very useful to the careful seedsman in that it helps to keep him always in the front line of progress. To a less extent than the market gardener and florist the seedsman is brought in immediate contact with the consumer, whose needs are the source of progress and new acquisitions. The former sometimes supply these needs, but often they turn to the seedsman and point out to him the prospect of increased profits as the reward for the creation of new and desirable varieties.

At the present day species that have been cultivated for many years have become, so to say, like wax in the hands of special

growers, who mould them and fashion them to their taste, obtaining the various modifications of shape, size, flavour, etc., demanded by the preferences of their patrons and the caprices of fashion.

### EXAMPLES OF SELECTION.

#### *Cabbage.*

It would be difficult to select a more striking example of the variations that selection can develop and fix than the cultivated forms of *Brassica oleracea*. As already stated, this plant is a native of the coasts of Western Europe, and is found on the shores of the Mediterranean, as well as on those of the Atlantic Ocean.<sup>1</sup> The wild plant grows principally on the calcareous cliffs on the border of the sea. It is a semi-herbaceous, semi-ligneous vegetable, flowering from the second year onward, much branched and making each year both flowering branches and vegetative branches which are to flower the year following. The leaves are thick and fleshy, as are the flowering branches, while the stem and the crown of the root are also to a certain extent swollen and thickened. All of these characters will be found exaggerated greatly in the cultivated varieties of *B. oleracea*, but not all of them in any one race. Ordinarily one of the organs of the plant is selected with a view to obtaining one of the 20 or 30 forms of vegetables which, identical or nearly so with the others in their essential characteristics of flower and fruit, present most divergent forms as far as the organs of vegetation are concerned.

Cabbages, which form the most important group of cultivated *B. oleracea*, represent the plant reduced to its most simple form, that is, to a single erect stem bearing at its upper extremity numerous large, thickened leaves, more or less closely crowded together, which, according to their shape and the manner in which they are laid over each other, form heads that are oval (as in York Sugar Loaf), conical (Early Etampes, Pomeranian), spherica (Joanet, Holland Short Stem), or flattened (St. Denis, Brunswick). The same forms are found again in the savoy, which differ from the ordinary cabbages in the form of development of the parenchyma between the little nerves of the leaves, giving the upper surface a blistered appearance: Oval (Long-Headed Savoy), conical (St. Jean Savoy), spherical (Victoria Savoy), and flattened (Roblet Savoy).

Again, the same variety of forms is found among the red cabbages, where the entire leaf is coloured a deep red: Conical (Red Conical), spherical (Red Dwarf Erfurt), flattened (Red Pologne).

All these forms without exception are the result of a patient and prolonged selection which has given to them almost complete permanence.

But these are not the only modifications of this plant, nor even

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<sup>1</sup> *Brassica oleracea* is a native of sea-cliffs in the south-west of England, Wales, and Ireland.—Ed.

of the leaves alone. There are the various headless cabbages or kale, which differ widely in respect of size, shape, and colour. One of them, the collard (Rosette Colewort), has round, spoon-shaped leaves, imbricated, but not crowded together to such an extent as to deprive those in the middle of air and light and thus blanch them, as is the case with the inner leaves of the head cabbage. There are numerous varieties of kales with the leaves green or red, entire or lacinate, flat or curled; Portugal cabbage, cow cabbage, branched kales (*B. oleracea ramosa*), palm borecole, and many besides, among which Brussels sprouts is not the least strange. On a simple, straight stem are ranged petiolate, flattened, spoon-shaped leaves. At the axil of each leaf is developed a little branch, the leaves of which fold over each other and are closely imbricated, forming a little hard head. Selection has solved the problem, apparently so difficult, of inducing the formation of heads on the branches of a stem without such formation at its top.

The stem of *B. oleracea*, as I have said, is in the wild type very large, and capable of becoming thickened. Taking advantage of this tendency, selection has established a form the entire stem of which becomes large and fleshy, and yields a product that can be used as a vegetable when it is young and tender, and is valuable as a food for cattle in winter when it has reached its full development.

If, instead of affecting the entire stem, the swelling is localised a little distance above the ground, the kohlrabi is formed, the varieties of which are numerous—large or small, early or late, white or violet.

The capability of becoming thickened and fleshy is not limited to the stem. The tap root possesses it also, and plants which showed a marked tendency to vary in this way, having been noticed and reproduced, have yielded, under the influence of long-continued selection, the turnip-rooted cabbage (*B. caulorapa*) and ruta-baga, the former of which has white flesh, the latter yellow. They are round, oblong, or flattened, and may weigh as much as 8 or 10 kg. (18 or 22 lb.). Selection has produced these numerous forms from a root that weighs scarcely 1 or 2 oz. in the wild state.

A still more remarkable modification was developed as follows: The floral branch of *B. oleracea* is very thick, and, especially at the early period of its growth, very tender and agreeable to the taste when cooked. Certain Italian gardeners noticed that the inflorescences of certain individuals had the sprouts larger and more thickened than others. Collecting the seed from these, and selecting among the descendants of the second generation those plants which yielded the largest and shortest floral shoots, they have succeeded in creating the very characteristic modification known as the cauliflower. Here the pedicels of the flower have become very much thickened and flattened at the expense of the flowers themselves, which on the principal shoots have become atrophied, and appear in small numbers only on the shoots of the third or fourth rank, which develop slowly on those heads which have not been cut at the time

when they were good to eat. With the principal result once obtained, selection has produced varieties of cauliflower, early or late, of varying size, white, yellow, rose, or violet in colour, and of various degrees of hardiness.

Here, then, is a plant the different races of which have come down in culture under such different forms that an unusual keenness of insight or the aid of botanical science is necessary to explain that they truly belong to one wild type, in which in one case the leaves, in another the inflorescences, in still another the stem or the root, have been literally modified by the power of selection to such an extent that from infinitely slight variations at the beginning the differences between the various races have become greater than are often found in nature between different species of the same genus ; and all of this has been accomplished by almost imperceptible steps under the influence of continued selection in a single direction.

Doubtless selection may be defined, but nothing can explain it so well as its results. For this reason I shall mention a few more examples taken from among the most common plants.

### *Celery.*

Take, for instance, celery.<sup>1</sup> This is an aquatic perennial plant, native in almost the entire basin of the Mediterranean, having its stem and petioles relatively large, tender, hollow, and of a pronounced aromatic odour. It was early observed in ditches and swamps, and introduced into cultivation. In the time of the Romans it was planted in gardens, more perhaps as an ornamental plant for use in domestic religious ceremonies than as a vegetable properly so called. When it came to be appreciated as a plant for the kitchen garden, it became an object of the gardener's attention. At first the size of the petioles was increased, then the plants with hollow petioles were eliminated as inferior to those in which the entire stalk was filled with tender, crisp flesh. Plants throwing up suckers were weeded out, because growth force is always more economically utilised when it concentrates about a single plant axis than when it is divided among several. The useful part of the celery being the stalk or petiole of the leaf, efforts were and are still directed toward the development of this organ by reducing others to the smallest size compatible with the good growth of the plant. The variety Pascal is very near to the present ideal of a green celery. The self-blanching celery was happened upon in the neighbourhood of Paris, perhaps a dozen years ago, by a very successful market gardener, Chemin. The original plant yielded seed from which was raised a good proportion of the new variety, but also some green plants. By persistent selection the proportion of green plants has been considerably reduced, but they have not yet entirely disappeared. By way of compensation this race has yielded a pretty variation with rose-coloured ribs, which is becoming fixed. White Plume and Boston

<sup>1</sup> Wild celery, *Apium graveolens*, is a native plant in England and Ireland, growing in marshy places by the sea.—ED.

Market are two good American varieties. The latter throws up many suckers, which is considered a defect according to European standards. But attention has not always been concentrated upon the petioles of the celery. Connoisseurs have not failed to observe that the fleshy roots on which the leaves are inserted possessed an especial flavour and were sweeter than the stalks, although not of as clear a colour. By selection certain plants have been obtained in which the root has been modified into a well-shaped and very regular, rounded enlargement, as in the Erfurt and Prague turnip-rooted celeries.

### Beet.

It should be noted in comparing the various races of *B. oleracea* that but one organ is enlarged. If this organ is the root, the leaves and the petioles are proportionately diminished in size, and serve only as auxiliary organs to the root. It is very difficult in general to develop two organs at the same time to any great degree in the same plant. In support of this assertion the beet<sup>1</sup> may be mentioned, as the history of its cultural evolution presents many analogies to that of the celery. I shall devote only enough time to it to point out certain differences between these two vegetables. In the first place, in the case of the beet it is the kind of root developed that is of greatest importance. In this case the leaves are only the organs of assimilation and of transformation of the food absorbed. The form having the leaves, or rather the petioles and ribs of the leaves, very much enlarged and the root small, branched, and fibrous, is known as the Swiss chard. Whenever there occurs an enlargement of the stalk or petioles properly so called, one may be certain that a decrease in the size of the root has already occurred or will occur immediately.

The deep red colour of garden beets is of very great importance. But in sugar beets, the absence of colour—that is, the perfect whiteness of the flesh of the root—is a condition of perfection. Selection has produced this very remarkable specialisation. There is no necessary or absolute correlation between the colour of the root and that of the foliage. In garden beets a thick, tender, sweet, and richly coloured flesh is much desired. Now, a variety may have these qualities without its foliage showing, at least for the greater part of the growing period, any particularly deep coloration. In England it was the fashion to produce varieties of garden beets with large and deeply coloured foliage (as in Dell's Dark Leaf Beet). Some men of independence and good judgment have not hesitated to say that this is putting colour to a bad use; that it is better to concentrate it in the root. As a matter of fact, the dark red Egyptian and Cheltenham Green Beets, and among the American varieties Edmand Early Turnip, are living proofs that a variety may have finely

<sup>1</sup> The wild beet, *Beta maritima*, is not uncommon on the British coasts. Benthams says (*British Flora*, p. 394): "The white and red Beets or Beetroot of our gardeners, and the *Mangel Wurzel* (*Root of Scarcity*) of our agriculturists, are cultivated varieties of this species."—ED.

coloured roots and at the same time preserve in its leaves a noticeable proportion of green surface. A third class might be made of those having very deeply coloured reddish-brown foliage, which are used for decorative purposes only, as, for instance, the *Dracæna Beut.* But in agreement with the rule already laid down, this race has a small root of no culinary value.

I cannot conclude this list of plants which have been modified by artificial selection in such divergent directions, and which so plainly bear the impress of man's activity, without mentioning a few ornamental plants as well as garden vegetables.

#### *Ornamental Plants.*

Take for instance the *Amaranth*. This is an annual plant from India, of rapid growth, with large alternate oval leaves and inconspicuous flowers in large bracteate clustered spikes. It has become, under the influence of selection, in one case a vegetable esteemed for its large and thickened leaves; in another case an ornamental plant, valued also for its leaves, which in this instance are variously coloured and variegated; and in a third case it is valued for its inflorescence, which is so curiously modified that one would hardly recognise at first sight the original type in the strange variations that have been developed from it.

Let us consider only the extremes, the *Cockscomb* and the feathered *Celosia*. The former is a low-growing stocky plant with its flowering head enormously developed. An accidental fasciation of the stem has been fixed by selection and augmented to such an incredible degree that the size of the stem at its top must be measured by dissecting all the reduplications which form the part of the plant called the comb. This coloured velvety mass, so ornamental in its bizarre effects, is the simple modification of an ordinary straight cylindrical stem into the comb.

From the same original type has been produced another entirely different plant. This is the feathered *celosia*, which is as graceful and light as the other is massive and stocky. Whereas all the stems were united into one in the cockscomb, they are here distinct, erect, and divided into ascending branches, each one of which ends in a plume having a varying number of filaments furnished with bright coloured silky bracts, and vary from golden yellow, through flame colour and crimson, to deep violet. In spite of such great differences in appearance between the two plants, it is not possible to observe the botanical characters and fail to recognise that both are modifications of the same original species.

From the same root are produced still other formations in which the ornamental part is not the inflorescence but the leaf, which is zoned or flagellated or bordered, sometimes with brown on a green groundwork, or sometimes with bright red on yellow or brown, or even simply on a brighter shade of red. All these pretty variations are the result of selection acting on the various forms found in nature or on modifications induced and patiently accentuated by man.

If it were not for the danger of making the list too long, many other examples of profound modifications brought about by the action of selection on the natural characters of wild plants could be mentioned. A single example that has been produced entirely within recent times will be instanced. The *Canna* was introduced into garden culture about 1820 as a foliage plant ; seeds were sown to obtain variations of form and colour of foliage, and the success of M. Année in this respect is well known. More recently M. Crozy, of Lyons, and other growers have directed their efforts to increasing the size of the flower, as a result of which we have the large-flowered varieties that to-day rival the gladiolus for garden decoration in summer. At the same time the colour of the flowers has increased in brilliancy. It may be said indeed that hybridisation has not been entirely unconcerned in this increase of size, but it is none the less selection that has taken advantage of the tendency thus introduced into the plant as a result of crossing, and that produces for us each year better varieties, the series of which is still far from being exhausted.

#### APPLICATION OF SELECTION.

If plants did not vary there could be no selection. The object of selection is to establish, fix, and sometimes to develop in plants certain qualities or new peculiarities which a plant has shown and someone has noticed.

It is not difficult to select plants. Anyone can do it ; but it is not so easy to do it profitably. In order to succeed, one must be not only patient, attentive to the work in hand, but must also exercise judgment and common sense.

Every modification that a plant shows is not necessarily worth fixing. Experience alone can tell whether it is worth perpetuating. The Chinese primrose is one of those plants that, within a short space of time—within fifty or sixty years—has produced a very great number of good varieties under the influence of selection. It seems that any new character that appears in these plants is easily established. Several times I have found in cultivation, both at Paris and in the Riviera, certain bordered flowers, that is, flowers having a lighter coloured border around a deeper coloured disc, but all of my efforts to fix this pretty variation have thus far been in vain.

When a variation in a cultivated form is noticed, one should ask himself first whether it is worth fixing ; for it is very evident that it would be time and labour lost if anyone should devote himself to the fixation of a character having neither interest nor usefulness. Several years ago a gardener brought to the writer a plant of a new celery that he had happened to find in a seed plot. He had transplanted it, saved the seeds from it, and sowed them, with the result that the type was reproduced very faithfully. It was a celery in which the pedicel or leaf-stalk was shortened almost to the point of disappearance. The many crowded leaves spread over the ground in a compact rosette, but the plant had practically lost the very

part that made it useful as a vegetable, that is, the stalks. I told him so, and did not conceal from him the fact that his novelty appeared to me to mark a step backward and not forward, somewhat as if one had discovered a potato without tubers. I could not convince him that his novelty was not a fine thing, and I believe he actually found a house that introduced it into trade among their novelties. If horticultural novelties were a rarity, one could realise that anything new would be received with eagerness ; but, as a matter of fact, novelties superabound, and one is tempted to say that the greatest virtue of a plant breeder is to be severe toward his own creations, and not easily to become enthusiastic over their real or supposed merits. Hence good judgment and experience are necessary in order to decide, when a variation appears, whether it is worth propagating or not, with a view to establishing a new variety in the course of time.

If, as is most often the case, there is but one plant that shows the modification, the only thing to do is to collect the seeds from it to be planted again. But even here there are certain precautions to be taken. If the plant is one of those in which cross-fertilisation takes place easily, it is advisable to remove the possibility of pollination by plants of the same kind which might be in the vicinity. There are two ways of doing this : one is to destroy all plants of the same kind except the one to be propagated, the other is to cover the flowers of this plant so that they are protected from the pollen of other plants. It is advisable, if the flowers have already begun to open when the variation is noticed, to destroy all those that might have been fertilised by the pollen of any other plant, as this would introduce an unknown parentage into the race.

For the sake of simplicity I shall first consider the commonest case, that of a plant capable of self-fertilisation, or one in which the different flowers of the same plant can fertilise each other, and do not require the aid of another plant of the same species. Seeds will then be collected only from those flowers which open after the plant has been covered. Suppose now that we have before us the seeds gathered from a plant that has shown the variation which we wish to propagate. The first thing to do is to sow these seeds in order to obtain a considerable number of young plants. The chances of finding something satisfactory among them naturally increases with the number of individuals among which we can choose. In this connection two important points are to be observed : (1) the inequality which is found in different cases in the proportion of plants conforming to the desired type in the first generation after the beginning of the selection. Sometimes, as has already been said, a single one is not obtained. Certainly this result is not encouraging ; nevertheless this is not always an unqualified reason for abandoning the task to which one has set himself. Occasionally it happens that by gathering the seed from the plants of the second generation, the characteristics of the plant originally selected may reappear in the following generation.

Sometimes, on the contrary, the observed variation may repro-

duce itself completely and entirely in the first generation. This case is rare, but nevertheless it does occur. One day I noticed in a lot of double violet clarkias a plant with pure white double flowers. When gathered and sown by themselves, the seeds of this plant yielded only pure white flowers which have never varied. The race was established in a single generation. Generally, however, the result is intermediate—that is, certain individuals show the desired characters, while others revert to the earlier form. We shall consider in due season the proper method in such a case.

Meanwhile, I proceed to take up the second point to which I have already referred, which is : (2) the necessity of sowing the seed under normal conditions. By these, I mean conditions which are not such as will influence artificially the characters of the plant produced by these seeds. In other words, structural or other peculiarities which the plants show should be the result of their natural tendencies and not the artificial result of cultivation. In a word, the plants under observation must have the opportunity to show their defects as well as good qualities. It goes without saying that a selection cannot be useful and valuable unless so made. One must be in a position to decide that a plant behaves in a certain manner because it has an innate tendency to do so, and that it has not been constrained to a certain form artificially. An illustration will make my point better understood than many explanations. In selecting sugar beets those roots are sought for that are straight, long, and free from lateral branches. This is right, for those that are branched are more difficult, and hence more expensive, to gather. Now, certain growers of beet seed in the north of France once formed the idea—thinking, no doubt, in this way to improve their varieties—of growing the plants which were to be used as seed stocks in very rich deeply worked soil, where they were very much crowded together ; so much so that 16 to 20, or even more, grew on one square metre of ground (= 1.2 sq. yd.). The result was that the beet assumed the form, and later the length, of a thick whipstock. They were not branched, because the roots were very closely crowded together. Their sugar content was abnormally high as a result of their growing so closely together, and the conclusions drawn from the form of the roots and their sugar content, as determined in the laboratory, were tainted with error because they did not represent qualities truly acquired, but modifications accidentally imposed by external conditions. Thus these beets, which were declared to be of good shape and composition in the laboratory, yielded seed which, when sown in the open field, produced branched roots of only moderate sugar content, because the descendants had reassumed their true characters when they were released from the restraint which had been artificially imposed on the parent plants. Those beets, alone, may be considered unbranched that are free from roots when they are cultivated under conditions that would permit them to become branched if they had such a tendency. In order to obtain seed that will produce unbranched roots, the plants from which the selection is to be made must be grown under conditions as nearly as possible like those under

which the same kind of plants are commonly grown that are intended for common domestic or industrial uses.

Let us return to a consideration of the successive operations of selection. Suppose that we have before us a lot of plants grown from seed of the plant which forms the point of departure in the establishment of a new variety. Of these plants some are *true to type*—that is, they reproduce faithfully the characters which we desire. Others have reverted to the older type, and we destroy them. We also destroy those which correspond only imperfectly to the ideal which we have set before ourselves. Let us suppose that the tenth part of these plants are true to type, and that we have twenty satisfactory plants before us. There are then open to us two methods of procedure. There is the method by individual selection of single plants and that of individual selection by group lots. The former is much the more exact, more simple, more direct, and less liable to error. But it has the disadvantage of being slow of operation, for at the end of three or four generations the grower still has only the seed produced by a single plant, and two or three years are still required to produce a large enough stock to introduce it into trade.

The method by group lots operates more rapidly, and at the same time affords a considerable probability of establishing the variety. It consists in selecting not a single plant, but as large a number of perfectly satisfactory plants as can be found by individual examination of all the plants in the lot. These plants are grown together, the seeds are collected in one lot, and are planted the following year (if the plant is an annual) in order to obtain a larger number of plants, from which a larger number of individuals may be selected than in the preceding year, thus providing a good quantity of the seed of the improved race in a short time. The weak point in this method is that one does not know in what manner each individual plant has reproduced itself, so that in selecting a good plant one does not know that it was not derived from a parent that produced only 5 or 10 per cent. of seed of the improved variety, the other nine-tenths reverting to the earlier type. This may happen, and, of course, hinder the complete differentiation and establishment of the race.

There is a method that may be said to be intermediate between the two already described, which embraces, to a great extent, the advantages of both without their disadvantage. It is the method of seeding by single plants. This method requires somewhat more labour and attention. It is as follows: In the first generation from the original plant, instead of selecting only one individual as in the first method, several are chosen, all of them perfectly satisfactory in appearance; but in place of sowing them together and collecting the seed in a mixture, as in the second method, each is grown sufficiently far away from the others to avoid cross-fertilisation and the seed from each plant is collected separately. Each lot is again sown separately the next year, and when the time comes to make a selection, the first step is to note to what extent each of the lots

thus obtained has faithfully reproduced the characters of the plant from which it has sprung. (For the sake of clearness and convenience each plant selected receives a number or letter by which it is designated and its pedigree may be followed.) A great difference is generally noticed in the behaviour of the different plants in respect to the transmission of their characters. Those that do not reproduce the desired characters are entirely rejected. If any are found, as often happens, that reproduce entirely those of the parent plant, such plant or plants only are preserved, and their descendants may be used immediately for the multiplication of the new variety, which is thus established with a constancy that the best horticultural varieties do not always possess.

This process of seeding by individual plants is one of the most powerful means which the plant breeder possesses to establish with certainty and relative quickness new varieties of cultivated plants. About twenty years ago I applied this method to the improvement of sugar beets, a work that was begun by my father in 1850, and that I have made one of my principal lines of business for twenty-five years. In the laboratory of Verrières, as everywhere else at the present time, the roots of the sugar beet are submitted individually first to a physical selection as to size, form, colour, etc., then to an examination by the polariscope for their sugar content. After this the most perfect roots are replanted and the seed from each one is collected and kept separate; but still, before using this seed for the multiplication of the variety on a large scale, those plants must be determined which, beside their own characters, are endowed with that special quality which consists of faithfully transmitting those characters to their descendants. A small sample of the seed from each root, enough to produce about fifty plants, is sown the next year. The roots produced are examined physically and chemically at the laboratory in the usual manner. If the result of the test is unfavourable, the rest of the seed is thrown away; but if the test is favourable—that is, if the roots from which the seed was produced have demonstrated that they reproduce and transmit faithfully to their descendants the qualities for which they were chosen—the rest of the seed is sown with suitable care so as to obtain as great an increase of the variety as possible. Now, it is a fact of observation that individual plants or animals are very unequally endowed in this respect. I have already referred to this fact when I mentioned the case of a new variety being established in a single generation. In an article on heredity, written in 1856, my father has so well presented this matter of the varying ability of individuals to transmit their own characters that I can do no better than quote the entire passage:—

“An example drawn from the animal world will make this idea clearer. Suppose two stallions eminently remarkable for eight characteristics, the same for both. Let the first of these characteristics be that of a fine head and shoulders, with the head shapely and well poised. We will not mention the other characteristics, which are of no importance to our argument, and pass directly to the

eighth. Let this eighth characteristic be that of being a good stallion, and, since we are only making a supposition, we will define this by saying that it consists in the ability to transmit to descendants seven-eighths of his own characteristics. Now let us advance one generation and consider two male offspring of these animals. The first has transmitted seven of these characteristics, but he has not transmitted the first; hence this colt will have a head that is too large, badly poised, and he will not carry it well; but, as he has received the quality of being a good stallion, he will transmit with tenacity to his descendants his unshapely head, compensated, however, by his other good qualities. Let the offspring of the second stallion, on the other hand, possess all the visible characteristics of his father, and be, to all appearances, a fine horse. But he has not received the eighth quality. In the second generation he will show his great defect. His offspring will have no common family resemblance, and all the fine qualities which he received from his sire will thus be lost to the further improvement of the race. This ability to impress a very pronounced character on their offspring, which certain stallions possess to a much higher degree than others, is a fact well known to those who devote themselves to the improvement of domestic animals; but it is not generally known that in the plant world this fact is even more pronounced, so much so that certain plants endow their descendants with such prepotency that a race, equivalent almost to a species group, is formed at a single leap, while at other times thousands of individuals may be raised from a plant showing some noticeable peculiarity without a single one of them reproducing the distinctive trait of the parent. But as this ability to transmit a specific character is not indicated by any external characteristic, and the result alone reveals its existence, it becomes necessary to be able to eliminate from the second generation all of the descendants of a plant imperfectly endowed in this respect; and for this reason I have been led to make it an absolute rule to keep the seed from different plants separate, and not to mix the seed of two plants intended to be used in improving a race, no matter how perfect and how much alike these plants may appear."

When, after two or three generations, it is seen that the new variety is not becoming constant, that at each generation the rever-sions to the old type or variations in all directions are still found, it is better to abandon the selection entirely, or, rather, cease to apply it to this lot, which is possibly lacking in the ability to transmit acquired characters, and to seek another point of departure in another individual better endowed in this respect.

#### DIRECTION OF SELECTION.

The characters that have determined the selection of a certain plant have just been spoken of. It is understood that anyone engaged in the selection of plants or animals is selecting for the purpose of improvement. Man's efforts to modify a plant by means

of selection, however, may be more or less skilfully directed. Besides, the result obtained, though expressing exactly the breeder's ideal, may be very differently estimated according to the circumstances and the country. The ideal of a fruit, vegetable, or flower varies greatly according to the tastes of different persons, and the influence of these different tastes must make itself felt in one way or another in the direction given to selection.

There are certain considerations of common sense that must be observed under all circumstances, which, if forgotten or disregarded, will lead to unfavourable results that will everywhere be recognised as such. It would be useless to attempt to unite in one and the same plant two characters which antagonise or interfere with the utility of each other. For instance, certain very dwarf beans are often widely advertised as producing pods of wonderful length. If the description is exact, and there is no reason to doubt that it is, the pods, being longer than the stem that bears them, would touch the ground and very often rot from contact with the damp soil. Common sense would show that very long pods should be borne by pole beans, and that very dwarf varieties should bear short but numerous pods.

For several years very large flowers have been the fashion, and pansies and begonias are shown in which the flower is as large as the open hand. It has never been demonstrated that this is progress in a right direction. These flowers that are so large and abundant have not always the substance and stiffness necessary to hold them upright. The result is that they bend under the slightest unfavourable atmospheric changes, or often even under their own weight, and frequently become much less beautiful than smaller but more substantial and numerous flowers. There is another instance of improvement, so called, which I am not alone in considering quite the opposite. There is a very pretty species of *helianthus* (*H. cucumerifolius*) which is much esteemed in America and in Europe as a cut flower in summer. Its flowers, 3 or 4 in. in diameter, are of a pretty shape and superb golden colour relieved by a black centre. They are much sought after for sheaves and large bouquets. A florist has selected a variety called *Stella*, which produces a much smaller number of flowers, 6 in. or more in diameter, like those of small varieties of the common sunflower, *H. annuus*. With the loss of its abundance of flowers this plant has also lost the grace and lightness which constituted its especial merit.

The above example brings out a point that must be taken into consideration in selection. It is that there exist in nature certain laws of equilibrium or of compensation that must be taken into account; as, for instance, the law that the size of the organs in any given variety of plant varies inversely as their number. The same variety does not produce both very large and very numerous flowers. This fact is especially noticeable in the cultivated cineraria (*Senecio cruentus*). The flowers, which in the wild plant are scarcely as large as the flowers of the true daisy (*Bellis perennis*), are usually bred to resemble those of the Ox-eye daisy (*Chrysanthemum leucan-*

*themum*). This is not a wise application of selection. When of this size, the flowers that a well-cultivated plant bears are no more than fifty or sixty in number. They cover the plant less completely than when they are a little smaller, but are 100 or 150 in number. The effect in the latter case is the more satisfactory. The details are lost in the mass of colour, and abortive or accidentally injured specimens do not break the solidity of the mass as when the flowers are individually of such size that the removal of one of them necessarily leaves a gap.

Neither can a plant be expected to be at once very productive and very early. Time is an element of considerable importance in the growth of plants. The plant that grows under favourable conditions of temperature and light for a month longer than another will necessarily produce a considerably greater weight of organic matter; but there are many cases in which great earliness is an absolute condition of production. It is understood that under such conditions earliness is sought before anything else. It is a local necessity that must be taken into account. The problem of selection is almost always complicated with particular local requirements, and this explains the extreme multiplicity of cultivated varieties which certain people condemn without considering the reason for their existence.

The rôle of selection has been of the greatest importance in the past, as can be seen by the examples already cited. It will continue to be of immense importance in the future, for it is certain that mankind, in proportion as it increases in number and takes possession more and more completely of the surface of the earth, will be obliged to obtain from it more and more of food and other useful products. To accomplish this, man must improve animals and plants, which are the instruments of organic production, just as he improves the implements and machines which are the instruments of industrial transformations. Moreover, mankind will be compelled to apply selection not only to species already known, but also to those which are yet to be discovered.

Up to the present time selection has been applied particularly to annuals or biennials, plants in which generations follow each other rapidly. Under the management of corporate bodies, such as associations and local governments, it could be applied, for example, to forest trees, in which the difference between the best and poorest specimens, as is well known, is extremely great. Since a well-established race of sugar beets has been obtained, why should not also a cork oak be bred, the cork of which will be of rapid development and faultless texture? The value of such a cork would be double or treble that of the ordinary article.

#### HOW SHOULD SEED BE COLLECTED FROM PLANTS?

In concluding these notes on selection, it appears advisable to touch upon a point to which certain people attach great importance, but on which my opinion does not agree with that usually held. I

refer to the custom of collecting seeds from some certain part of a plant in preference to another. There is no idea more prevalent in gardening than that of the superiority of seeds collected from the base of the central stem over those of the top of the same stem, and especially over those of the lateral branches. I have made and had made experiments on this subject, and I have invariably found no difference among the seeds collected from various parts of the same plant with respect to the proportion of single and double plants obtained. I have repeated these experiments many times on ornamental plants with respect to the doubling of flowers, on vegetables with respect to the size and quality of the roots, and on cereals with respect to the yield in weight and the appearance of the seed, and I have always found that while individual plants may differ from each other in respect to the transmission of characters, yet from the same plant there was great uniformity of results obtained. The larger seeds produce slightly more vigorous plants in the earlier periods of growth, but do not give any guarantee of ability to transmit superior qualities. When a plant is known to be thoroughbred, and its ability to transmit its own characters has been established, I should always prefer the smallest seed that came from it, although collected from the part of the plant which is considered the least favourable in the common opinion, to the largest seed taken from the part believed to be most favourable of a plant whose pedigree is less certain.

#### CONCLUSIONS.

Selection is the surest and most powerful instrument that man possesses for the modification of living organisms.

Variations are easily induced by change of environment and cultivation. The latter is an addition of especial importance, because it permits variations which are spontaneously produced to be easily observed and selected.

These modifications may affect the external characters of form, shape, and colour, or the internal qualities of flavour, perfume, chemical composition, etc.

Selection may modify organisms in any direction not incompatible with the preservation of life ; but there are certain characters that are mutually antagonistic : individual size and number of parts, great productiveness and extreme earliness, relatively large size of a part and very intense coloration. In order to be effective, selection must be continued in one and the same direction.

The value of the results obtained depends on the ability and judgment of the breeder. Varieties may degenerate as well as improve under selection.

The unit of selection is the individual. The superiority of one seed over others from the same individual, with respect to the transmission of characters, cannot be foretold.

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## RECENT AGRICULTURAL INVENTIONS.

*The subjects of Applications for Patents from December 12, 1899,  
to March 10, 1900.*

N.B.—Where the Invention is a communication from abroad, the name of the Inventor is shown in *italics*, between parentheses, after the name of the applicant.

### Agricultural Machinery and Implements, &c.

No. of Application. Year 1899.	Name of Applicant.	Title of Invention.
24810	BEHRINGER, S. . . .	Ploughs.
25128	DENTS, D. . . .	Potato diggers.
25148	LAKE ( <i>W. S. King Co., U.S.A.</i> ) . . .	Machines for cutting grass.
25150	WENCK, A. . . .	Artificial manure.
25424	UNTERLIP, F. W. . . .	Ploughs.
25570	HANRAHAN. . . .	Conveyors and elevators for reaping machines.
25885	THIES, H. . . .	Potato digger.

#### Year 1900.

485	JONES, L. M., & others	Self-binding harvesters.
865	BASFORD, W., & anr.	Machine for digging, &c., potatoes.
975	SAUVEGARDE, J. . . .	Threshing machines.
1011	HORNSBY, J. W., & ors.	Ploughs.
1502	KELSEY, G. . . .	Chaff-cutting machines.
1505	JENKS, A. E. . . .	Spades, forks, &c.
1520	ALLEN, H. . . .	Hay-loader.
1541	WILLIS, P. R. ( <i>Bone, D. &amp; C., U.S.A.</i> ) . . .	Cutter bar for reaping machines.
1778	IRVINE, A. J. . . .	Machines for thinning turnips, &c.
1868	KLEIN, J. . . .	Double harrow.
1911	LAKE, H. H. ( <i>Bushnell &amp; Co., U.S.A.</i> ) . . .	Mowing machines.
2121	GILLISPIE, W. J. . . .	Hoeing and cleaning turnips.
2355	TASKER, H., & anr.	Elevators.
2380	JACK, J. H. ( <i>Mil- waukee Harvester Co., U.S.A.</i> ) . . .	Harvesters.
2442	HANSEN, H. . . .	Ploughs.
3076	CZÁVÁN, O. . . .	Shaking apparatus for threshing machines,

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
3190	FISCHER, A. T., & anr.	Seed drills.
3426	BAWDEN, R. . . .	Turn-wrest plough.
3610	GREENSLADE, J. . .	Threshing machine.
3756	HOLME, T. ( <i>Bach, N., &amp; ors., Denmark</i> ) .	Machine for thinning and cleansing turnips, and double-moulding, sowing, and hilling.
3907	GOSS, J. P. . . .	Drill coulters.
3919	GOUGH, A. . . .	Germinating grain and withering malt.
3964	REDLINGTON, W. . .	Root-crop top-cutter.
4040	PLUESCHKE, G. J. ( <i>Tonko, M., Austria</i> ).	Potato-sowing machines.
4041	Ditto	Digging and harrowing.
4116	FOWLER, R. H. & B. .	Ploughs.
4176	STRAWSON, G. F. . .	Means for spraying crops.
4373	BRYAN, G. C. N. . .	Swath turners.

### Stable Utensils and Fittings—Horse-shoes, &c.

Year 1899.

24581	JOHNS, S. T. . . .	Frost-shoe.
24762	DOUGLAS, R. . . .	Pneumatic under-saddle.
24798	CREASEY, J. J. . .	Horse-shoes.
25029	MILNER, G. . . .	Riding saddles.
25135	LEVY, J. ( <i>Barnet, N., Victoria</i> ) . . . .	Nosebags.
25345	ELLAM & another . .	Horse-shoe.
25578	TAYLOR, C. F. . . .	Hame tugs.
25611	STAUNTON, P. M. . .	Saddles.
25722	WÖLKER, A. . . .	Horse-shoes.
25728	KINGSCOTE, E., & anr.	Protecting horses from sickness.
25771	TILDESLEY, W. H. . .	Curry combs.

Year 1900.

71	BEIRNE, T. . . .	Stirrup.
145	TABERNEIRO, A. . .	Nostril-closing apparatus for stopping runaway horses.
152	FRANKE, C. R. . . .	Curry comb.
168	JENKS, A. E. . . .	Whip sockets.
328	HODGKINSON, J. H. R.	Horse-shoes.
465	WILLIS, P. R. J. ( <i>Arthur, A., U.S.A.</i> ) . . . .	Securing traces to thills.
505	DUNNACHIE, J. . . .	Clipping machines.
579	CARTER, J. . . .	Side saddles.
645	DOUGLAS, B. . . .	Harness.
704	MCCAFFREY, J. . . .	Saddles.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
1042	WOOLRIDGE, S. C.	. Self-fastening frost-cogs.
1149	GULLINE, H. L.	. Attachments for horse-collars.
1471	SANGSTER, T. H.	. Nosebags.
1565	BOULT, A. J.	. Trace gear.
1584	PETERS, M. & R.	. Horse-shoes.
1681	HAHN, A.	. Horse-shoe.
1684	MARSH, F.	. Nosebag.
1821	THOMSON, E.	. Horse-collar.
2174	GARLAND, W. F.	. Opening and fixing horses' jaws.
2279	PRINCE, P.	. Horse-shoes.
2528	HLAWITSCHKA, A.	. Hobble for temporarily securing horses left unattended.
2576	WATTS, J. R.	. Hook for removing stones, &c., from horses' feet.
2610	NUNN, J. N.	. Rubber horse-shoe pad.
2792	OLSEN, C. B.	. Harness.
2924	CHETTLE, T.	. Controlling vicious stallions.
2932	MACKEY, R. M.	. Horse loin-covers.
3279	WALLEY, J. S.	. Trace-fasteners for vehicles.
3408	MORLEY, W.	. Knee halter.
3538	GOETZE, W.	. Rein holder.
3585	CLEMMSON, E. C.	. Nosebags.
3602	GÖTTSCHE, A. H.	. Releasing or unfastening appliance.
3794	HARGREAVES, E. B.	. Horse clothing.
3859	STEVENSON, J. C.	. Buckle for harness.
3997	MITCHELL, F. H.	. Horse clothing.
4197	DIEDRICH, E.	. Blinkers.
4344	VERITY, H.	. Riding saddles.
4396	DOUGLAS, R.	. Saddlery and harness.
4474	RAINSFORD, R. ( <i>Dud- ley, H. H., U.S.A.</i> )	. Checking horses.
4581	WINNER, T.	. Triplicate gig saddle plate.

## Dairy Utensils, &amp;c. . .

## Year 1899.

25084	WILLIAMS, H. C.	. Milk churns (preserving).
25264	BOOTH, J., & another	. Vents or valves for churns.
25668	ALLEN, O. J.	. Cheese-making vessel.

## Year 1900.

298	HALL, F.	. Fastener for milk-churns
1775	FOULKE, L. H.	. Mechanism for churning
1823	NILSSON, F. O.	. Journalling device for centrifugal separator drums.
1829	POPPE, M.	. Manufacture of margarine.
1939	BARR, J., & another	. Cow-milking machines.

No. of Application.	Name of Applicant.	Title of Invention.
Year 1900.		
2153	BEACH, E. W. . .	Centrifugal separators.
3255	APLIN, J. S. . .	Milk churns.
3260	MIRACLE, M. . .	Machine for cutting cheese.
3307	PORTER, T. G., & anr. .	Drainer presses for cheese making.
3620	BABHAM, A. S. . .	Lids of milk churns.
3846	HOUSE, J., & another .	Lining for dairy utensils.
3847	" " . .	Apparatus for drying dairy utensils.
3986	WILLIAMS, H. C. . .	Treating and preserving milk churns.
4357	WILSON, J. . .	Cheese cutters.

**Poultry and Game, &c., Appliances.**

Year 1899.

24769 GALWAY, J. L. . . Foster-mothers.

Year 1900.

1065	EVERALL, J. B. . .	Heat regulators of incubators.
1164	OXFORD, A. J. . .	Using yeast as poultry food.
1242	APPLEGARTH, R. . .	Incubating apparatus.
1501	WALL, E. F. . .	Nest boxes.
1771	SIMMINS, S. . .	Foster-mothers.
2615	BALLS, A. H. . .	" "
3044	WHALLEY, J. F. . .	" "
3128	WATTS, W. J. . .	Incubators.
3344	HOOPER, J. A. . .	Foster-mother.
3799	WALKER, A. . .	Hatching and rearing house.
3934	SUTCLIFFE, J. H. . .	Humidity regulator for incubator.

**Miscellaneous.**

Year 1899.

24600	HAMPTON, F., & anr. .	India-rubber feeding appliance for young stock
24729	FRENCH, A. W. . .	Machines for trimming oil-cakes.
25037	SALISBURY, W. . .	Calf trough.
25429	MARBIOTT, J. . .	Food for animals.

Year 1900.

568	COULTHURST, A. . .	Drinking-troughs for cattle, &c.
2389	RYMER, W. H. . .	Feeding appliance for cattle, &c.
2527	HLAWITSCHKA, A., & another . . .	Cattle food.
3507	BARTON, W. W. . .	Clipping and shearing machine.
3521	MACILWAINE, A. W. .	Treating castor-oil seeds for use as food for cattle.
3651	KIBOHWEGER, T. . .	Introducing and removing Queen-bees into and from bee-hives.

**Numbers of Specifications relating to the above subjects published  
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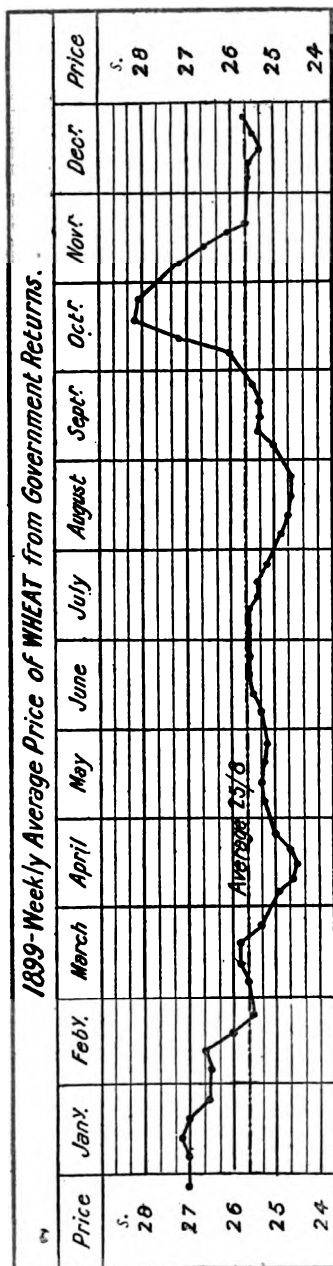
53, 251, 291, 2432, 3014, 3524, 3530, 8631, 3703, 3730, 4067, 4578, 4735, 4949,  
5101, 5185, 5186, 5378, 6219, 6590, 7323, 7880, 8897, 8426, 8730, 9234,  
9264, 9400, 9479, 9576, 9860, 9973, 10138, 10740, 11362, 12815, 15075,  
15819, 16860, 19335, 20960, 21782, 22385, 22557, 22602, 22645, 23307  
24232, 24810, 25722.

**Specifications of 1900.**

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<sup>1</sup> Copies may be obtained at the Patent Office (Sale and Store Branch)  
Quality Court, Chancery Lane, London, E.C.



## THE PRICE OF ENGLISH CORN IN 1899.

AVERAGE PRICES PER IMPERIAL QUARTER FOR 1899.—Wheat, 25s. 8d.; Barley, 25s. 7d.; Oats, 17s.

(Each space between the lines of the diagram represents fourpence.)

THE above diagram shows the Imperial average price of English *Wheat* in the year 1899 to have been 25s. 8d. per quarter, a fall of 8s. 4d. as compared with 1898, when it was 34s. The highest weekly average was 28s. 2d. at October 21, and the lowest 24s. 6d. at April 15, the fluctuation amounting to 3s. 8d. per quarter, as compared with 22s. 8d. in 1898.

The average price of English *Barley* in 1899 was 25s. 7d. per quarter, against 27s. 2d. in the preceding year, or a fall of 1s. 7d. The highest weekly average was 28s. 3d. at January 7, the lowest 20s. 4d. at July 15, the fluctuation amounting to 7s. 11d. per quarter, against 5s. 4d. in 1898. In 34 weeks of last year the price of barley exceeded that of wheat.

The average price of English *Oats* in 1899 was 17s. per quarter, or 1s. 5d. less than in 1898, when the average was 18s. 5d. The highest weekly average was 18s. 2d. at June 10 and July 29, and the lowest 16s. at December 23, the fluctuation being 2s. 2d. per quarter, whereas in 1898 it amounted to 4s. 11d.

The foregoing values are per Imperial quarter—i.e., wheat, 480 lb.; barley, 400 lb.; oats, 312 lb.

Willich's Tables state the septennial tithe-rent charge for 1900 to be 66*l.* 15s. 9*d.* for 100*l.*, or about 1*½* per cent. less than last year. The average value of 100*l.* of the tithe-rent charge for the 64 years which have elapsed since the passing of the Tithe Commutation Act of 1836 is 96*l.* 11s. 2*d.*

## STATISTICS AFFECTING BRITISH AGRICULTURAL INTERESTS.

**TABLE I.—Average Prices of British Corn per Quarter (Imperial Measure), as received from the Inspectors and Officers of Excise conformably to the Act of 45 & 46 Vict. ch. 37, in each Week of the Year 1899.**

[Compiled from the "London Gazette."] ]

Week ending	Wheat	Barley	Oats	Week ending	Wheat	Barley	Oats
1899	s. d.	s. d.	s. d.	1899	s. d.	s. d.	s. d.
January 7 . . .	27 0	28 3	17 0	July 1 . . .	25 7	24 2	18 0
January 14 . . .	27 2	28 2	17 1	July 8 . . .	25 7	21 9	18 1
January 21 . . .	27 0	27 11	17 1	July 15 . . .	25 5	20 4	17 11
January 28 . . .	26 7	27 9	17 0	July 22 . . .	25 5	21 10	18 0
February 4 . . .	26 6	27 2	17 0	July 29 . . .	25 2	22 5	18 2
February 11 . . .	26 8	27 2	17 0	August 5 . . .	24 10	20 9	18 0
February 18 . . .	26 0	26 10	16 11	August 12 . . .	24 8	22 6	17 9
February 25 . . .	25 7	26 7	16 11	August 19 . . .	24 7	26 11	17 4
March 4 . . .	25 8	26 7	17 0	August 26 . . .	24 7	26 5	17 1
March 11 . . .	25 10	26 7	16 11	September 2 . . .	25 0	25 10	16 7
March 18 . . .	25 10	26 3	16 10	September 9 . . .	25 5	26 5	16 6
March 25 . . .	25 4	26 8	17 0	September 16 . . .	25 4	27 1	16 2
				September 23 . . .	25 4	27 4	16 1
				September 30 . . .	25 6	26 11	16 5
Average of Winter Quarter }	26 3	27 1	16 11	Average of Summer Quarter }	25 2	24 4	17 3
April 1 . . .	24 11	26 2	16 11	October 7 . . .	26 0	28 0	16 5
April 8 . . .	24 7	25 1	16 11	October 14 . . .	27 3	27 9	16 5
April 15 . . .	24 6	25 7	16 10	October 21 . . .	28 2	27 6	16 10
April 22 . . .	24 8	25 2	17 1	October 28 . . .	28 1	27 4	16 3
April 29 . . .	25 0	25 10	17 5	November 4 . . .	27 2	27 2	16 7
May 6 . . .	25 3	24 5	17 6	November 11 . . .	26 7	26 9	16 5
May 13 . . .	25 4	23 11	17 9	November 18 . . .	26 1	26 4	16 7
May 20 . . .	25 3	23 11	17 10	November 25 . . .	25 8	26 2	16 7
May 27 . . .	25 2	23 8	17 8	December 2 . . .	25 7	25 10	16 6
June 3 . . .	25 4	24 4	18 1	December 9 . . .	25 7	25 10	16 5
June 10 . . .	25 6	21 10	18 2	December 16 . . .	25 4	25 7	16 1
June 17 . . .	25 7	23 1	17 10	December 23 . . .	25 6	25 10	16 0
June 24 . . .	25 7	26 2	17 11	December 30 . . .	25 9	25 5	16 2
Average of Spring Quarter }	25 1	24 6	17 6	Average of Autumn Quarter }	26 4	26 6	16 4

TABLE II.—*Annual Average Prices and Quantities of British Corn sold in the Towns in England and Wales from which Returns are received under the Act of 45 & 46 Vict. ch. 37, in each of the Years 1890 to 1899.*

[From the "London Gazette."]

Year	Wheat		Barley		Oats		Wheat	Barley	Oats
	s.	d.	s.	d.	s.	d.	Qrs.	Qrs.	Qrs.
1890	31	11	28	8	18	7	3,439,699	3,327,991	599,083
1891	37	0	28	2	20	0	3,248,743	3,255,518	561,713
1892	30	3	26	2	19	10	3,052,879	3,493,634	492,166
1893	26	4	25	7	18	9	2,620,080	3,366,056	575,522
1894	22	10	24	6	17	1	1,956,824	2,729,348	565,747
1895	23	1	21	11	14	6	1,928,383	3,426,576	665,939
1896	26	2	22	11	14	9	2,111,021	3,391,862	655,153
1897	30	2	23	6	16	11	2,756,561	3,257,187	550,434
1898	34	0	27	2	18	5	2,602,416	3,653,657	688,064
1899	25	8	25	7	17	0	3,530,961	3,296,744	776,361

TABLE III.—*Returns published pursuant to the Corn Returns Act, 1882, and to Act of 6 & 7 Wm. IV. for "Commutation of Tithes in England and Wales," showing what has been, during the Seven Years ending Christmas Day in each Year, the Average Price of an Imperial Bushel of British Wheat, Barley, and Oats, computed from the Weekly Averages of Corn Returns in each of the Years 1893 to 1899.*

[From the "London Gazette."]

Year	Average (Septennial) Prices per Bushel					
	Wheat		Barley		Oats	
	s.	d.	s.	d.	s.	d.
1893	3	11	3	4	2	3½
1894	3	9	3	4	2	3½
1895	3	7	3	2½	2	3
1896	3	6½	3	2	2	2½
1897	3	5½	3	1	2	2
1898	3	5½	3	0½	2	1½
1899	3	4½	3	0½	2	1

TABLE IV.—*Average Prices of Wool in each of the Years 1893 to 1899.*

Year	ENGLISH <sup>1</sup>			AUSTRAL- ASIAN	SOUTH AFRICAN
	Leicester	Half-breds	Southdown		
	Per lb. d. d.	Per lb. d. d.	Per lb. d. s. d.	Per lb. d.	Per lb. d.
1893	8½ to 9½	9½ to 10½	10½ to 1 0	8½	9½
1894	9 " 10	9½ " 10½	9½ " 1 0	8½	9½
1895	9½ " 10½	9½ " 11	9½ " 0 11½	8	9½
1896	9½ " 11	9½ " 10½	9½ " 0 11½	8½	7½
1897	8½ " 10	8½ " 9½	8½ " 0 10½	8½	7½
1898	8 " 8½	7½ " 8½	8½ " 0 9½	8½	7½
1899	7 " 8	7 " 8½	7½ " 0 11	9	7½

<sup>1</sup> The prices of English wool have been calculated from the list given weekly in the *Economist*.

TABLE V.—Numbers and Values of Live Cattle, Sheep, and Swine Imported into the United Kingdom in the Years 1897, 1898, and 1899.

[From Trade and Navigation Returns.]

		Number			Value		
		1897	1898	1899	1897	1898	1899
Cattle	From Channel Islands	1,633	1,814	1,732	\$ 31,048	\$ 34,785	\$ 33,101
	" Canada . . .	126,495	108,405	94,660	2,045,209	1,774,760	1,596,097
	" United States .	416,299	369,478	321,229	7,230,854	6,238,984	5,541,781
	" Argentine Re- public .	73,852	89,369	85,365	1,153,507	1,351,264	1,392,599
	" Other Countries	42	. .	518	378	. .	8,536
Total . .		618,321	569,066	503,504	10,460,996	9,329,793	8,572,114
Sheep and Lambs	From Canada . . .	63,761	42,070	63,930	95,602	63,286	100,320
	" United States .	186,755	147,021	121,030	272,421	219,706	184,446
	" Argentine Re- public .	345,217	430,073	382,080	528,607	637,888	598,436
	" Other Countries	15,771	44,583	40,715	22,466	64,483	59,689
	• Total . .	611,504	663,747	607,755	919,096	984,863	942,891
Swine (not separately enu- merated) . . . .		. .	450	2	. .	1,020	7
TOTAL VALUE OF LIVING ANIMALS (for Food)		. .	. .	. .	11,380,092	10,385,676	9,515,012

TABLE VI.—Quantities and Values of Fruit, Vegetables, and Hops, Imported into the United Kingdom in the Years 1897, 1898, and 1899.

[From Trade and Navigation Returns.]

	Quantity			Value		
	1897	1898	1899	1897	1898	1899
Apples . . . . .	Bushels 4,199,971	Bushels 3,458,716	Bushels 3,861,172	£ 1,187,303	£ 1,108,056	£ 1,186,143
Cherries . . . . .	312,294	401,810	281,236	178,131	230,828	153,642
Plums . . . . .	1,043,819	922,248	558,273	497,783	434,666	294,052
Pears . . . . .	1,051,877	491,669	581,832	377,900	221,779	266,351
Grapes . . . . .	993,713	1,135,759	1,158,215	495,017	549,513	588,684
Oranges . . . . .	8,797,203	7,274,312	8,550,494	2,266,920	1,986,960	2,181,219
Lemons . . . . .	1,548,918	1,631,644	1,687,935	410,150	439,285	453,011
Unenumerated . . . .	1,725,116	2,177,132	2,248,268	695,159	870,711	925,470
Onions . . . . .	6,108,924	6,002,515	7,008,298	760,560	792,909	845,782
Potatoes . . . . .	Cwt. 3,921,205	Cwt. 6,751,728	Cwt. 5,157,811	1,200,328	1,913,912	1,577,519
Vegetables, Raw, unenum'd .	164,154	244,136	180,233	1,456,701	1,680,786	1,744,068
Hops . . . . .				524,297	1,030,140	809,842

TABLE VII.—Quantities and Values of Animals for Food, and of Corn, Meat, Dairy Produce, Poultry, and Eggs, Imported into the United Kingdom in the Years 1897, 1898, and 1899.

[From Trade and Navigation Returns.]

	Quantities			Values		
	1897	1898	1899	1897	1898	1899
<b>ANIMALS, LIVING (for food):—</b>	No.	No.	No.	£	£	£
Cattle . . . . .	618,321	569,068	503,504	10,460,996	9,399,793	8,572,114
Sheep and Lambs . . . . .	611,504	663,747	607,755	919,096	984,863	942,891
Swine . . . . .	...	450	2	...	1,020	7
<b>TOTAL VALUE</b> . . . . .	...	...	...	11,380,092	10,385,676	9,515,012
<b>CORN:—</b>	Cwt.	Cwt.	Cwt.	£	£	£
Wheat . . . . .	62,740,180	65,227,930	66,539,978	23,363,403	26,147,256	22,282,701
Wheat Meal and Flour . . . . .	18,680,669	21,017,109	22,946,708	9,599,656	11,545,443	10,700,990
Barley . . . . .	18,958,720	24,457,004	17,189,358	4,681,074	6,791,472	4,960,332
Oats . . . . .	16,116,810	15,577,900	15,626,630	4,038,813	4,382,857	4,199,734
Peas . . . . .	2,830,135	2,179,192	2,753,960	771,055	689,769	893,951
Beans . . . . .	2,840,050	2,293,346	1,877,220	762,275	670,159	573,891
Maize . . . . .	53,785,880	57,169,292	62,699,650	9,188,708	11,282,310	12,967,303
Oatmeal . . . . .	732,495	989,480	789,810	434,673	615,928	505,464
Maize Meal . . . . .	1,029,301	1,453,800	1,814,766	261,130	379,485	457,534
Other kinds of Corn and Meal . . . . .	2,059,208	1,462,764	1,964,697	478,593	404,588	541,772
<b>TOTAL OF CORN</b> . . . . .	179,762,948	191,827,817	194,297,767	53,579,474	62,909,264	58,083,561
<b>MEAT:—</b>	Cwt.	Cwt.	Cwt.	£	£	£
Beef, Salted . . . . .	174,936	208,945	178,183	215,901	273,004	230,943
„ Fresh . . . . .	3,010,387	3,100,821	3,802,622	5,783,667	5,915,705	7,344,733
Mutton, Fresh . . . . .	3,193,276	3,314,001	3,446,032	4,837,868	4,902,179	5,439,407
Bacon . . . . .	5,004,915	5,711,322	5,804,683	8,867,846	10,321,674	10,400,803
Hams . . . . .	1,725,875	1,972,299	1,978,621	3,681,966	3,894,839	4,094,500
Pork, Salted (not Hams) . . . . .	237,306	275,993	284,720	263,693	319,778	305,839
„ Fresh . . . . .	247,617	557,802	668,972	765,128	1,165,380	1,403,041
Meat, unenumerated—Salted or Fresh . . . . .	264,822	414,977	464,782	737,273	812,738	883,363
Meat preserved otherwise than by Salting . . . . .	669,684	574,937	652,424	1,702,315	1,802,440	1,896,733
Rabbits (dead) . . . . .	276,458	314,398	277,291	543,494	572,603	623,635
<b>TOTAL OF DEAD MEAT</b> . . . . .	15,005,176	16,445,295	17,668,220	27,369,151	29,980,340	32,637,796
<b>DAIRY PRODUCE:—</b>	Cwt.	Cwt.	Cwt.	£	£	£
Butter . . . . .	3,217,802	3,209,153	3,389,851	15,916,917	15,961,783	17,212,516
Margarine . . . . .	936,543	900,615	953,175	2,485,370	2,384,384	2,549,376
Cheese . . . . .	2,603,178	2,330,452	2,889,313	5,835,521	4,970,342	5,515,091
Milk, Condensed . . . . .	756,243	817,274	824,618	1,398,363	1,435,951	1,456,032
<b>TOTAL VALUE</b> . . . . .	...	...	...	25,686,171	24,762,360	26,734,016
<b>POULTRY, &amp;c.:—</b>				£	£	£
Poultry and Game, alive or dead . . . . .	...	...	...	730,735	637,492	785,294
Eggs . . . . .	Gt. Hunds. 14,031,754	Gt. Hunds. 14,424,601	Gt. Hunds. 16,174,760	4,356,807	4,467,117	5,044,393
<b>TOTAL VALUE</b> . . . . .	...	...	...	5,087,532	5,094,609	5,829,686

TABLE VIII.—Quantities and Values of Dead Meat Imported into the United Kingdom in the Four Years 1896 to 1899.

[From Trade and Navigation Returns.]

Thousands ("000") omitted.

DEAD MEAT		1896		1897		1898		1899	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
COWS :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
	From United States . . .	2,752	4,087	3,593	5,354	4,087	6,438	4,089	6,552
	„ Denmark . . .	1,222	2,792	1,037	2,744	1,018	2,701	1,211	2,946
	„ Canada . . .	457	696	290	523	536	996	454	762
	„ Other Countries . . .	119	300	95	247	71	187	52	141
	Total . . .	4,550	7,855	5,005	8,868	5,711	10,322	5,806	10,401
PIGS :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
Salted	From United States . . .	241	295	172	212	204	267	175	227
	„ Other Countries . . .	7	9	3	4	5	6	3	4
	Total . . .	248	304	175	216	209	273	178	231
Fresh	From United States . . .	2,075	4,216	2,242	4,609	2,302	4,677	2,757	5,712
	„ Other Countries . . .	585	813	768	1,175	799	1,238	1,046	1,632
	Total . . .	2,660	5,029	3,010	5,784	3,101	5,916	3,803	7,345
LAMB :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
	From United States . . .	1,286	2,758	1,604	3,412	1,862	3,651	1,824	3,781
	„ Canada . . .	169	365	119	260	117	233	151	301
	„ Other Countries . . .	4	12	3	10	3	10	4	12
	Total . . .	1,459	3,136	1,726	3,682	1,972	3,895	1,979	4,094
LAMB, Unenumerated :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
Salted or Fresh	From Holland . . .	163	345	225	472	250	518	254	526
	„ United States . . .	61	99	76	127	90	157	123	214
	„ Other Countries . . .	56	110	64	129	75	139	87	143
	Total . . .	279	554	365	727	415	813	465	883
Preserved, other- wise than by Salting . . .	Beef . . .	402	1,054	373	1,000	281	1,017	366	1,065
	Mutton . . .	123	202	99	161	118	195	87	156
	Other Sorts . . .	177	520	198	541	175	590	199	676
	Total . . .	702	1,776	670	1,702	575	1,802	652	1,897
PORK, Fresh :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
	From Holland . . .	239	516	267	592	266	585	285	629
	„ Australasia . . .	1,853	3,105	2,009	3,040	1,934	2,941	2,001	3,275
	„ Argentine Republic . . .	802	1,072	909	1,175	1,106	1,358	1,141	1,490
	„ Other Countries . . .	11	25	9	20	8	19	18	45
	Total . . .	2,895	4,719	3,193	4,828	3,314	4,902	3,446	5,439
BEEF (not Name) . . .		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
	From United States . . .	138	176	141	168	175	225	164	200
	„ Other Countries . . .	118	116	96	86	101	95	121	106
	Total . . .	256	292	237	254	276	320	285	306
PORK . . .	From Holland . . .	244	557	226	489	223	474	344	728
	„ Belgium . . .	39	98	37	93	35	88	35	92
	„ Other Countries . . .	16	32	86	184	300	603	239	583
	Total . . .	299	687	348	765	558	1,165	669	1,403
OTHERS :—		Cwt.	£	Cwt.	£	Cwt.	£	Cwt.	£
	From Belgium . . .	92	251	84	227	85	239	81	217
	„ Australasia . . .	54	80	168	251	205	275	267	342
	„ Other Countries . . .	26	71	24	66	25	68	30	80
	Total . . .	171	402	276	543	315	573	377	639
TOTAL OF DEAD MEAT		12,518	24,752	15,005	27,369	16,445	29,980	17,658	32,638

**TABLE IX.—Quantities and Values of Butter, Margarine, Cheese, Milk, Poultry, and Eggs Imported into the United Kingdom in each of the Years 1897, 1898, and 1899; also Countries from which they were obtained.**  
*[From Trade and Navigation Returns.]*

	QUANTITIES			VALUES		
	1897	1898	1899	1897	1898	1899
<b>BUTTER</b>						
From Sweden . . . .	Owt. 299,214	Owt. 294,962	Owt. 245,599	£ 1,515,705	£ 1,501,668	£ 1,246,137
" Denmark . . . .	1,334,726	1,465,030	1,430,052	6,748,163	7,359,831	7,553,436
" Germany . . . .	51,761	41,231	36,953	263,097	214,046	186,573
" Holland . . . .	278,631	269,324	284,810	1,353,349	1,329,438	1,417,641
" France . . . .	448,128	416,821	353,942	2,330,576	2,183,845	1,908,848
" New South Wales . .	23,835	34,391	43,561	112,218	167,618	215,274
" Victoria . . . .	169,075	124,223	211,744	816,399	605,611	1,051,358
" New Zealand . . .	76,522	69,949	111,639	366,956	338,400	543,367
" Canada . . . .	109,402	156,865	250,083	444,862	661,935	1,118,956
" United States . . .	154,196	66,712	159,137	633,549	285,309	704,061
" Other Countries . .	272,312	269,645	262,331	1,332,043	1,314,082	1,272,865
<b>Total . . . .</b>	<b>3,217,802</b>	<b>3,209,153</b>	<b>3,389,851</b>	<b>15,916,917</b>	<b>15,961,783</b>	<b>17,213,516</b>
<b>MARGARINE</b>						
From Norway . . . .	10,827	8,477	8,278	29,785	22,799	22,654
" Holland . . . .	872,473	844,177	897,806	2,291,796	2,209,809	2,378,944
" France . . . .	30,563	30,299	27,721	106,105	106,309	96,250
" Other Countries . .	22,680	17,662	19,370	57,684	46,467	51,528
<b>Total . . . .</b>	<b>936,543</b>	<b>900,615</b>	<b>953,175</b>	<b>2,485,370</b>	<b>2,384,384</b>	<b>2,549,376</b>
<b>CHEESE</b>						
From Holland . . . .	297,604	292,925	328,585	748,251	724,936	810,103
" France . . . .	36,358	33,086	34,307	110,087	94,102	103,159
" Australasia . . . .	68,615	44,608	37,494	161,776	91,161	84,318
" Canada . . . .	1,526,664	1,432,181	1,337,198	3,349,501	2,943,725	3,014,211
" United States . . .	631,616	485,995	590,737	1,413,079	1,006,686	1,380,609
" Other Countries . .	42,321	50,657	60,992	102,827	109,732	122,692
<b>Total . . . .</b>	<b>2,603,178</b>	<b>2,339,452</b>	<b>2,389,313</b>	<b>5,885,521</b>	<b>4,970,242</b>	<b>5,515,091</b>
<b>MILK (condensed)</b>						
	756,243	817,274	824,618	1,398,363	1,435,951	1,456,033
<b>POULTRY (and Game)</b>						
From Russia . . . .	...	...	...	186,825	164,498	139,834
" Belgium . . . .	...	...	...	164,179	127,923	165,803
" France . . . .	...	...	...	256,113	217,703	296,555
" Other Countries . .	...	...	...	123,608	127,868	183,102
<b>Total . . . .</b>	<b>...</b>	<b>...</b>	<b>...</b>	<b>730,725</b>	<b>637,492</b>	<b>785,294</b>
<b>EGGS</b>						
From Russia . . . .	Great Hundreds 3,132,338	Great Hundreds 3,645,903	Great Hundreds 4,318,601	£ 812,297	£ 966,129	£ 1,183,031
" Denmark . . . .	1,748,800	2,019,508	2,266,030	596,282	685,447	808,543
" Germany . . . .	2,971,846	2,821,128	3,454,986	813,022	788,844	966,641
" Belgium . . . .	2,464,182	2,349,962	2,457,558	768,077	730,898	759,250
" France . . . .	2,675,667	2,115,096	2,288,562	1,022,869	817,836	867,865
" Canada . . . .	568,769	745,355	646,867	193,998	251,710	233,693
" Other Countries . .	470,157	727,649	742,156	150,262	216,753	225,369
<b>Total . . . .</b>	<b>14,031,754</b>	<b>14,424,601</b>	<b>16,174,760</b>	<b>4,356,807</b>	<b>4,457,117</b>	<b>5,044,392</b>

TABLE X.—*Values of Corn and Meal Imported into the United Kingdom in each of the Five Years, 1895 to 1899.*

[From Trade and Navigation Returns.]

	1895	1896	1897	1898	1899
	£	£	£	£	£
Wheat . . . . .	22,531,176	21,678,989	23,363,503	26,147,266	22,282,701
Wheat Flour . . . . .	7,679,013	9,227,873	9,599,666	11,545,443	10,700,990
Total . . . . .	30,210,189	30,906,862	32,963,159	37,692,699	32,983,691
Barley . . . . .	5,538,405	5,709,531	4,681,074	6,791,472	4,960,332
Oats . . . . .	3,723,465	4,226,317	4,038,813	4,382,867	4,199,724
Maize . . . . .	7,808,860	9,422,539	9,188,708	11,282,310	12,967,202
Maize Meal . . . . .	75,523	123,313	261,120	379,485	457,534
Peas . . . . .	693,828	852,634	771,055	689,769	898,951
Beans . . . . .	1,079,780	837,417	762,275	670,159	573,891
Oatmeal . . . . .	277,736	330,966	434,672	615,925	505,464
Other kinds of Corn and Meal . . . . .	315,507	390,504	478,598	404,588	541,772
Total of Corn, &c. . . . .	49,723,293	52,800,083	53,579,474	62,909,264	58,088,561

TABLE XI.—*Quantities of Wheat, and of Wheat Meal and Flour, Imported into the United Kingdom in each of the Five Years, 1895 to 1899; also the Countries from which they were obtained.*

[From Trade and Navigation Returns.]

Thousands ("000") omitted.

	1895	1896	1897	1898	1899
WHEAT from—	Owt.	Owt.	Owt.	Owt.	Owt.
Russia . . . . .	23,017	17,242	15,050	6,232	2,519
Germany . . . . .	753	1,033	1,333	711	466
Turkey . . . . .	1,300	1,930	1,363	272	27
Roumania . . . . .	2,022	5,401	1,221	184	32
United States . . . . .	27,084	30,695	34,603	37,855	34,651
Chile . . . . .	1,039	1,936	1,019	807	266
Argentine Republic . . . . .	11,400	4,928	933	3,983	11,869
British East Indies . . . . .	8,803	2,113	573	9,538	8,192
Australasia . . . . .	3,487	7		212	3,703
Canada . . . . .	1,845	3,618	4,821	5,012	5,256
Other Countries . . . . .	1,000	1,124	1,324	421	156
TOTAL WHEAT . . . . .	81,750	70,026	62,740	65,228	66,637
WHEAT MEAL AND FLOUR from—	Owt.	Owt.	Owt.	Owt.	Owt.
Germany . . . . .	244	205	74	107	61
France . . . . .	1,126	1,719	1,682	438	642
Austrian Territories . . . . .	1,306	1,388	1,144	729	1,030
United States . . . . .	13,132	15,905	14,063	17,446	18,406
Canada . . . . .	2,343	1,933	1,531	1,968	2,499
Other Countries . . . . .	218	170	187	328	309
TOTAL WHEAT MEAL AND FLOUR . . . . .	18,368	21,320	18,681	21,017	22,946

**TABLE XII.—Numbers of Horses, Cattle, Sheep, and Pigs Imported into Great Britain from Ireland in each of the Years 1893 to 1899.**

	1893	1894	1895	1896	1897	1898	1899
<b>HORSES:</b>							
Stallions . . .	161	163	188	191	153	140	122
Mares . . . .	13,356	14,484	15,370	18,046	17,590	18,300	19,471
Geldings . . .	16,883	18,912	19,002	21,619	20,679	20,454	22,491
<b>Total . .</b>	<b>30,390</b>	<b>33,559</b>	<b>34,560</b>	<b>39,856</b>	<b>38,422</b>	<b>38,894</b>	<b>42,087</b>
<b>CATTLE:</b>							
Oxen, } Fat .	316,344	330,748	309,555	274,472	259,173	273,770	278,064
Bulls, } Store.	318,545	422,534	414,859	349,800	419,302	460,903	442,921
and } Other							
Cows } Cattle .	8,473	7,805	5,622	3,837	5,043	4,101	6,219
Calves . . . .	45,807	65,867	68,571	53,451	62,494	59,588	45,068
<b>Total . .</b>	<b>688,669</b>	<b>826,954</b>	<b>791,607</b>	<b>681,560</b>	<b>746,012</b>	<b>803,362</b>	<b>772,272</b>
<b>SHEEP:</b>							
Sheep . . . .	705,299	574,471	351,975	397,164	435,709	449,558	452,070
Lambs . . . .	402,661	382,630	300,603	340,142	368,806	383,500	419,883
<b>Total . .</b>	<b>1,107,960</b>	<b>957,101</b>	<b>652,578</b>	<b>737,306</b>	<b>804,515</b>	<b>833,458</b>	<b>871,953</b>
<b>Pigs:</b>							
Fat . . . . .	405,342	515,647	500,700	574,677	653,459	556,723	630,850
Store . . . . .	51,329	69,320	46,520	35,912	41,848	32,062	37,703
<b>Total . .</b>	<b>456,671</b>	<b>584,967</b>	<b>547,220</b>	<b>610,589</b>	<b>695,307</b>	<b>588,785</b>	<b>668,553</b>

**TABLE XIII.—Numbers of Horses, and their Declared Value, Imported into, and Exported from, the United Kingdom in each of the Years 1894 to 1899.**

[From Trade and Navigation Returns.]

Year	IMPORTED		Year	EXPORTED	
	Number	Value		Number	Value
		£			£
1894	22,866	548,058	1894	16,457	449,804
1895	24,092	921,490	1895	21,564	549,882
1896	40,877	1,027,736	1896	29,414	671,323
1897	49,519	1,254,362	1897	34,471	825,246
1898	42,921	1,146,324	1898	36,412	842,106
1899	43,900 <sup>1</sup>	1,143,307	1899	33,825	758,017

<sup>1</sup> NOTE.—The countries from which horses were imported in 1899 were as follow: United States, 25,169; Canada, 4,792; other countries, 13,939.

**TABLE XIV.—Numbers and Prices of Live-stock in 1897, 1898, and 1899, as returned under the Markets and Fairs (Weighing of Cattle) Act 1891.**

[From Journal of the Board of Agriculture.]

NUMBERS OF ANIMALS reported as ENTERING THE SCHEDULED PLACES in Great Britain, together with the Numbers WEIGHED and the Numbers PRICED.

Animals	1897	1898 <sup>1</sup>	1899 <sup>1</sup>
<b>CATTLE:</b>	No.	No.	No.
Entering markets . . . . .	1,115,183	1,263,991	1,236,091
Weighed . . . . .	111,767	138,652	139,482
Prices returned . . . . .	100,371	124,197	124,552
Prices returned with quality distinguished . . . . .	78,329	102,299	103,613
<b>SHEEP:</b>			
Entering markets . . . . .	4,194,310	4,691,619	4,681,602
Weighed . . . . .	41,969	49,953	48,643
Prices returned with quality distinguished . . . . .	36,692	40,460	42,154
<b>SWINE:</b>			
Entering markets . . . . .	211,613	363,370	455,056
Weighed . . . . .	2,333	1,614	2,205
Prices returned with quality distinguished . . . . .	1,368	1,437	2,070

**CALCULATED AVERAGE PRICE PER LIVE CWT.  
IN TWELVE SELECTED PLACES**

(obtained by dividing the total price by the total weight of the weighed fat cattle, of all descriptions, in each of the three qualities or grades).

Places	Inferior or third quality		Good or second quality		Prime or first quality	
	1898	1899	1898	1899	1898	1899
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
<b>ENGLAND:</b>						
Carlisle . . . . .	25 10	26 10	29 10	30 8	32 10	34 6
Leeds . . . . .	28 0	28 0	29 4	28 10	32 0	32 2
Liverpool . . . . .	24 0	24 6	28 0	30 0	31 10	33 6
London . . . . .	25 2	26 4	32 4	33 8	36 6	38 0
Newcastle . . . . .	26 0	28 4	29 10	32 8	33 4	36 2
Shrewsbury . . . . .	24 6	28 2	29 8	31 2	34 2	34 10
<b>SCOTLAND:</b>						
Aberdeen . . . . .	23 10	25 4	31 8	33 2	34 8	36 10
Dundee . . . . .	26 10	26 4	31 4	32 10	33 8	35 2
Edinburgh . . . . .	28 10	30 0	32 8	34 6	34 0	36 6
Falkirk . . . . .	28 2	29 4	31 10	33 2	34 0	35 2
Glasgow . . . . .	31 0	31 8	32 2	33 0	33 10	35 4
Perth . . . . .	30 2	30 2	32 4	33 0	34 8	35 6

<sup>1</sup> Includes the returns from Carlisle and Falkirk.

TABLE XV.—*Home Product and Importations of Sheep and Mutton (United Kingdom) in each Year from 1885 to 1899.*

[From Messrs. W. Weddel &amp; Co.'s "Review of the Frozen Meat Trade, 1899," corrected to date.]

Year	Population at the middle of each year	Number of Sheep and Lambs enumerated annually in June (from Agricultural Returns)	Estimated Dead Weight of Sheep and Lambs slaughtered, say 40 per cent. of Total Number	Weight of Fresh Mutton and Lamb, and estimated Dead Weight of Sheep Imported
			Tons	Tons
1885	(estimated) 36,015,601	80,086,200	322,000	47,365
1886	" 36,313,582	28,955,240	310,000	58,588
1887	" 36,599,143	29,401,750	315,000	63,537
1888	" 36,881,271	28,988,716	310,000	73,360
1889	" 37,178,929	29,484,774	316,000	78,285
1890	" 37,484,764	31,667,195	339,000	91,783
1891	(census) 37,704,283	33,533,988	359,000	91,762
1892	(estimated) 38,106,675	33,642,808	360,000	86,974
1893	" 38,440,249	31,774,824	340,000	100,142
1894	" 38,779,031	30,037,818	322,000	127,917
1895	" 39,166,821	29,774,853	318,500	157,155
1896	" 39,558,489	30,853,809	329,000	164,000
1897	" 39,954,073	30,567,061	327,500	174,950
1898	" 40,353,613	31,102,359	333,000	182,294
1899	" 40,757,149	31,680,225	339,400	187,495

TABLE XVI.—*Number of Tons of Frozen Mutton and Lamb Imported into the United Kingdom from the Countries named in each Year from 1885 to 1899.*

Year	From New Zealand	From River Plate	From Australia	Totals
	Tons	Tons	Tons	Tons
1885	14,200	5,611	2,678	22,489
1886	17,328	9,520	1,885	28,733
1887	19,782	12,563	2,122	34,467
1888	24,931	17,269	2,224	44,424
1889	28,425	19,765	2,105	50,295
1890	39,366	21,754	5,491	66,611
1891	44,806	21,818	8,366	74,990
1892	38,283	23,556	10,586	72,425
1893	45,015	25,780	14,357	85,152
1894	48,553	29,286	23,421	101,260
1895	58,552	36,406	25,266	120,224
1896	53,955	40,136	38,823	132,914
1897	65,116	45,431	35,338 <sup>1</sup>	145,885
1898	65,730	55,310	30,974 <sup>1</sup>	152,014
1899	73,786	57,064	26,287 <sup>1</sup>	157,137

<sup>1</sup> Decrease owing chiefly to drought in New South Wales and Queensland.

**TABLE XVII.—Quantities and Values of Wool, Wood, Seeds, Manures, &c., Imported into the United Kingdom in the Years 1897, 1898, and 1899.**

[Compiled from Trade and Navigation Returns.]

	QUANTITY			VALUE		
	1897	1898	1899	1897	1898	1899
<b>WOOL : Sheep and Lambs' .</b>	Lb. 735,627,420	Lb. 689,446,139	Lb. 659,408,683	£ 24,436,871	£ 22,437,188	£ 23,579,769
<b>WOOD AND TIMBER :</b>						
Hewn . . . . .	Loads 2,825,665	Loads 2,331,755	Loads 2,667,049	5 780,389	4,890,689	5 327,292
Sawn or Split, Planed or Dressed . . . .	7,024,492	6,363,357	6,635,754	16,639,981	15,056,040	16,201,172
Staves . . . . .	126,745	139,120	126,216	569,572	646,075	659,342
<b>SEEDS :</b>						
Clover & Grass	Cwt. 299,946	Cwt. 342,773	Cwt. 299,268	579,258	655,211	549,535
Cotton . . . . .	Tons 412,876	Tons 430,432	Tons 357,962	1,925,351	2,069,111	2,036,550
Flax or Linseed . . . .	Qrs. 1,908,618	Qrs. 1,688,515	Qrs. 1,798,887	2,988,503	2,920,634	3,383,962
Rape . . . . .	185,232	258,951	207,649	258,233	367,736	307,053
<b>MANURES :</b>						
Bones (burnt or not) . . . .	Tons 59,228	Tons 59,406	Tons 67,915	217,592	245,639	313,659
Guanos . . . . .	16,784	23,644	26,911	89,812	117,924	140,075
Nitrate of Soda . . . .	103,805	130,327	140,851	797,445	972,801	1,069,771
Phosphate of Lime & Rock	324,788	330,610	418,944	491,813	502,422	680,57
<b>MISCELLANEOUS :</b>						
Cotton, Raw . . . .	Cwt. 15,394,289	Cwt. 19,004,896	Cwt. 14,520,391	32,195,172	34,125,554	27,673,039
Flax . . . . .	Tons 98,802	Tons 97,253	Tons 99,052	3,208,184	2,932,646	2,927,355
Hemp . . . . .	89,019	94,442	91,973	1,763,402	2,308,480	2,663,547
Linen Yarn . . . . .	Lb. 15,907,161	Lb. 15,738,320	Lb. 25,558,113	618,375	599,846	1,011,961
Hides, Raw : . . . .	Cwt. 557,087	Cwt. 543,212	Cwt. 446,285	1,413,166	1,454,935	1,148,652
Dry . . . . .	638,668	694,154	764,240	1,336,991	1,451,029	1,641,514
Wet . . . . .	1,278,818	1,248,673	1,365,239	7,647,457	7,788,261	8,581,310
Leather . . . . .	Gallons 185,665,376	Gallons 219,249,539	Gallons 239,922,681	3,835,271	3,733,682	4,572,789
Petroleum . . . . .	Cwt. 1,740,468	Cwt. 2,106,871	Cwt. 2,188,049	1,993,143	2,887,801	3,068,985
Lard . . . . .	Tons 336,898	Tons 390,753	Tons 441,933	1,834,729	2,284,244	2,649,180
Oil-seed Cake . . . .						

TABLE XVIII.—*Summary of Agricultural Produce Statistics (Beans, Peas, Potatoes, Roots, and Hay) for England, Wales, Scotland, and Great Britain in 1899 and in 1898.*<sup>1</sup>

	Estimated Total Produce		Area		Estimated Yield per Acre		Average Yield per Acre 1899-98
	1899	1898	1899	1898	1899	1898	
BEANS.							
	Bushels	Bushels	Acres	Acres	Bushels	Bushels	Bush.
England	7,005,000	6,692,000	384,528	217,387	29.90	30.83	29.74
Wales	36,000	36,000	1,338	1,338	27.29	28.28	25.39
Scotland	440,000	472,000	13,190	13,412	33.66	35.26	32.40
Great Britain	7,481,000	7,200,000	249,056	231,964	30.09	31.07	27.03
PEAS.							
	Bushels	Bushels	Acres	Acres	Bushels	Bushels	Bush.
England	4,359,000	4,783,000	169,887	173,050	27.31	27.69	26.10
Wales	36,000	34,000	1,665	1,569	21.22	21.87	19.60
Scotland	27,000	32,000	1,199	1,325	24.04	25.47	24.85
Great Britain	4,421,000	4,849,000	162,761	175,944	27.23	27.62	26.04
POTATOES.							
	Tons	Tons	Acres	Acres	Tons	Tons	Tons
England	2,254,000	2,256,000	387,715	365,432	5.81	6.17	6.06
Wales	173,000	185,000	32,985	32,797	5.24	6.62	5.76
Scotland	650,000	842,000	126,985	126,362	5.11	6.66	5.74
Great Britain	3,077,000	3,283,000	547,682	524,591	5.62	6.26	5.95
TURNIPS AND SWEDES.							
	Tons	Tons	Acres	Acres	Tons	Tons	Tons
England	9,574,000	13,083,000	1,203,880	1,237,011	7.95	10.58	12.69
Wales	735,000	1,012,000	66,936	68,176	10.99	14.84	15.13
Scotland	5,752,000	7,242,000	470,277	487,315	12.23	15.50	15.25
Great Britain	16,061,000	21,337,000	1,740,993	1,772,505	9.23	12.04	13.43
MANGELS.							
	Tons	Tons	Acres	Acres	Tons	Tons	Tons
England	6,378,000	6,084,000	362,302	342,962	17.56	17.68	17.42
Wales	130,000	129,000	8,855	7,854	14.64	16.39	16.25
Scotland	30,000	25,000	1,785	1,419	16.87	18.04	16.98
Great Britain	6,538,000	6,218,000	373,942	352,235	17.48	17.65	17.39
HAY CUT FROM CLOVER, SAINFOIN, AND ROTATION GRASSES.							
	Tons	Tons	Acres	Acres	Cwt.	Cwt.	Cwt.
England	2,208,000	3,034,000	1,622,603	1,779,341	27.22	34.09	28.15
Wales	241,000	285,000	198,046	199,959	24.28	28.52	22.98
Scotland	598,000	688,000	394,234	402,251	30.90	34.21	31.27
Great Britain	3,044,000	4,007,000	2,214,883	2,381,551	27.48	33.65	28.22
HAY CUT FROM PERMANENT GRASS.							
	Tons	Tons	Acres	Acres	Cwt.	Cwt.	Cwt.
England	4,380,000	5,883,000	3,763,867	3,922,220	23.24	29.99	23.41
Wales	414,000	549,000	457,173	474,492	18.09	23.12	18.33
Scotland	185,000	200,000	128,045	129,603	29.03	30.89	28.47
Great Britain	4,979,000	6,632,000	4,359,085	4,526,315	22.95	29.24	23.06

<sup>1</sup> A similar summary for Wheat, Barley, and Oats in 1899 and in 1898 is given in the preceding issue (No. 40) of the Journal, 3rd series, vol. x. (part iv.) 1899, p. 788.

**Rainfall, Temperature and Bright Sunshine experienced over England and Wales during the whole of 1899, with Average and Extreme Values for Previous Years.**

RAINFALL										
Districts	TOTAL FALL					NO. OF DAYS WITH RAIN				
	For previous 33 years					For previous 18 years				
	In 1899	Extremes				In 1899	Extremes			
		Aver- age	Driest		Wettest		Aver- age	Driest		Wettest
			in.	in.				in.	in.	
North-eastern counties . . .	24.3	25.9	19.9 (1884)	37.2 (1872)	178	183	162 (1884)	208 (1894)		
Eastern counties . . .	22.4	25.3	19.1 (1874 and 1887)	33.1 (1872)	158	183	156 (1898)	205 (1894)		
Midland " . . .	25.2	27.9	19.2 (1887)	39.8 (1872)	154	179	148 (1887)	210 (1882)		
Southern " . . .	25.0	28.8	21.5 (1887)	41.7 (1872)	137	174	150 (1887 and 1898)	197 (1882)		
North-western counties, including North Wales	35.6	38.6	24.9 (1887)	59.2 (1872)	187	197	163 (1887)	222 (1882)		
South-western counties, including South Wales	38.7	42.6	38.3 (1887)	68.6 (1872)	175	200	159 (1887)	235 (1882)		
Channel Islands <sup>1</sup> . . .	29.1	32.7	26.2 (1887)	39.5 (1882)	169	213	181 (1887)	251 (1886)		

Districts	MEAN TEMPERATURE					HOURS OF BRIGHT SUNSHINE				
	For previous 33 years					For previous 18 years				
	In 1899	Extremes				In 1899	Extremes			
		Average	Coldest		Warmest		Average	Cloudiest		Sunniest
	°	°	°	°						
North-eastern counties .	48.3	47.3	45.0 (1879)	49.2 (1898)	1356	1288	1006 (1885)	1558 (1893)		
Eastern counties . . .	49.6	48.4	45.8 (1879)	51.0 (1868)	1864	1541	1267 (1888)	1831 (1893)		
Midland " . . .	49.2	48.3	45.8 (1879)	51.1 (1868)	1627	1398	1173 (1888)	1715 (1893)		
Southern " . . .	51.4	49.5	46.9 (1879)	51.6 (1898)	1983	1553	1245 (1888)	1875 (1893)		
North-western counties, } including North Wales }	49.5	48.4	45.9 (1879)	50.8 (1868 and 1893)	1606	1336	1198 (1888)	1519 (1887 and 1897)		
South-western counties, } including South Wales }	51.4	50.2	48.3 (1888)	52.8 (1868)	1807	1650	1459 (1888)	1964 (1893)		
Channel Islands <sup>1</sup> . . .	54.3	52.0	50.7 (1885)	53.9 (1893 and 1898)	2117	1912	1710 (1888)	2300 (1893)		

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office.

<sup>1</sup> For the Channel Islands the "Averages" and "Extremes" of Rainfall and Mean Temperature are for the previous eighteen years only.

**The Rainfall of 1899 and of the previous Ten Years, with the Average Annual Fall for a long period, as observed at thirty-eight stations situated in various parts of the United Kingdom.**

Stations	1899		Rainfall of Previous Years										Average Rain-fall
	Total Rain-fall	Difference from Average	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	
			In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
ENGLAND AND WALES :													
Durham . . . . .	24.5	-13	30.8	21.8	24.5	27.6	23.7	20.1	24.1	24.6	26.0	20.7	28.2
York . . . . .	23.4	-14	23.7	24.4	22.2	25.8	28.0	22.3	24.7	23.8	23.7	23.0	26.0
Stamford . . . . .	21.6	-18	19.1	23.1	23.4	20.4	22.5	17.0	21.9	27.1	21.3	28.1	26.4
Yarmouth . . . . .	22.4	-17	20.9	20.8	21.3	23.3	26.8	19.5	30.5	24.2	24.1	26.9	27.1
Cambridge . . . . .	19.3	-17	17.9	20.4	20.7	22.8	23.0	21.4	25.7	28.0	17.9	26.4	23.3
Rothamsted . . . . .	25.1	-12	18.7	25.0	29.0	25.4	29.6	23.8	23.8	30.5	23.5	29.1	28.6
Loughborough . . . . .	23.1	-11	20.0	23.9	23.5	23.0	21.0	19.1	21.0	30.0	19.0	27.1	25.9
Cheadle . . . . .	30.9	-9	27.8	32.8	29.3	29.5	27.2	27.4	31.3	35.7	28.5	30.8	34.0
Hereford . . . . .	26.7	-1	22.4	26.7	18.2	24.1	29.2	18.9	21.3	27.5	18.2	25.2	27.1
Gloucester . . . . .	26.7	-16	22.1	32.7	22.6	25.8	35.2	20.7	22.8	26.5	22.2	26.5	31.9
Oxford . . . . .	21.0	-18	19.1	26.3	23.5	22.5	29.7	17.6	20.5	27.5	17.8	23.5	25.7
London . . . . .	22.0	-11	17.8	22.3	22.7	21.4	23.7	19.2	23.0	25.1	23.8	24.7	24.8
Hastings . . . . .	25.8	-13	23.0	28.1	29.9	28.6	35.8	27.2	26.9	30.6	29.1	28.9	29.5
Southampton . . . . .	27.6	-12	26.6	32.6	26.8	28.2	34.9	23.5	23.9	33.8	26.4	25.4	31.3
Stonyhurst . . . . .	47.5	-1	47.9	51.3	44.2	42.4	50.5	50.7	48.3	46.9	50.2	42.6	47.9
Manchester . . . . .	33.5	-11	33.2	39.1	38.4	34.2	39.2	31.9	42.4	39.9	33.9	34.7	37.8
Liverpool . . . . .	27.6	-4	28.6	28.4	26.6	26.2	29.1	24.4	33.0	31.6	27.1	27.4	28.9
Llandudno . . . . .	32.4	+4	31.3	30.7	30.4	30.1	29.1	36.6	33.5	32.8	28.2	28.5	31.1
Llandoverly . . . . .	44.7	-11	47.5	50.1	41.8	41.4	55.3	40.0	36.7	58.6	46.0	41.0	50.2
Clifton . . . . .	35.4	+1	30.9	38.9	27.6	32.0	40.6	23.9	26.4	42.5	24.9	30.5	35.2
Cullompton . . . . .	37.0	+3	29.9	38.9	27.6	34.8	40.4	29.9	29.9	39.2	31.4	30.8	35.6
Plymouth . . . . .	33.1	-10	29.2	40.4	29.1	37.8	42.5	31.0	26.9	39.8	36.6	33.8	36.6
Bolton (St. Mary's) . . . . .	31.9	-6	27.1	35.7	22.8	29.9	38.0	26.5	25.1	36.9	32.4	27.5	34.0
Jersey (St. Aubin's) . . . . .	26.3	-23	30.0	36.2	33.2	34.7	39.1	29.7	31.2	35.6	33.8	32.2	34.2
* Mean for the whole of England and Wales													
	28.6	-11	26.2	31.3	28.5	29.0	33.1	25.6	29.3	33.5	28.6	26.8	32.0
SCOTLAND :													
Wick . . . . .	29.7	+4	27.4	21.9	34.7	32.9	29.5	34.9	33.6	31.2	33.4	31.7	28.5
Aberdeen . . . . .	30.3	-2	27.5	28.7	31.2	35.8	28.6	29.5	29.8	29.5	32.4	28.1	30.6
Braemar . . . . .	35.6	-1	36.5	36.8	30.2	32.7	41.9	30.8	28.1	34.4	32.2	29.7	36.0
Leith . . . . .	24.8	+6	19.9	20.5	21.7	21.9	26.1	19.2	20.6	22.6	26.0	20.0	23.4
Fort Augustus . . . . .	42.3	+1	54.3	41.9	43.6	43.4	54.7	47.3	44.6	48.2	49.8	32.8	41.9
Fort William . . . . .	72.2	-6	102.4	74.7	71.1	58.1	78.8	83.7	72.7	78.7	89.2	65.4	77.2
Glasgow . . . . .	43.5	+10	37.4	29.7	35.9	32.9	42.8	38.9	37.1	36.5	38.9	30.6	39.6
Glenlee . . . . .	59.8	+5	54.5	62.2	50.7	47.6	62.1	47.8	53.5	60.7	54.5	49.5	57.0
* Mean for the whole of Scotland													
	46.1	+14	47.4	41.5	43.7	39.7	45.6	42.8	41.5	44.5	46.9	36.3	40.4
IRELAND :													
Londonderry . . . . .	37.9	-5	41.3	41.6	41.9	39.5	40.4	38.9	39.9	36.4	43.5	39.8	40.1
Markree Castle . . . . .	43.7	+6	40.4	46.1	42.3	38.4	44.3	36.2	41.6	35.6	40.6	43.5	41.3
Armagh . . . . .	32.5	+4	31.8	36.1	31.2	30.5	33.1	24.3	32.5	28.8	30.1	30.7	31.2
Dublin . . . . .	27.7	0	27.1	29.4	29.9	31.2	29.3	30.5	26.7	27.8	27.6	27.2	27.4
Parsonstown . . . . .	33.1	+1	34.2	37.8	32.4	29.0	35.9	28.3	33.9	31.8	30.7	27.0	32.7
Kilkenny . . . . .	30.9	-6	29.1	41.4	29.2	33.7	38.2	26.5	32.1	34.6	31.2	30.3	32.7
* Mean for the whole of Ireland													
	40.6	+3	38.6	44.5	38.0	36.8	40.8	33.3	39.1	38.4	40.1	38.1	39.4

\* The Average Fall is in nearly all cases deduced from observations extending over the thirty years 1866-95.

\* The Mean Rainfall for each country is based upon observations made at a large number of stations in addition to those given above.

# JOURNAL OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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## VARIOUS CONDITIONS AFFECTING THE MALTING QUALITY OF BARLEY.

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### 1. INTRODUCTORY.

IN a previous communication to this Journal we endeavoured to set forth some of the available evidence bearing upon the manurial conditions which affect the malting quality of barley.<sup>1</sup> Size of grain and degree of maturation, the latter being the more important, were indicated as the qualities likely to be directly or indirectly influenced. The market value of a sample of barley is, of course, not determined wholly by these conditions.

<sup>1</sup> Journal R.A.S.E. 3rd ser. vol. viii. part i. 1897, p. 65.

Grain which has lost its vitality through bad harvesting conditions is no longer suitable for malting purposes, and on the important subject of injury by threshing machines it is to be hoped that enough has been said to ensure its remedy, so far as it is remediable, in the near future. It is proposed now to deal with some other conditions, so far as they also affect quality of grain in the directions indicated.

## 2. VARIETIES AND CROSS-FERTILISATION.

The specific character of the varieties of barley now in cultivation, and the possibility of improving their quality by cross-fertilisation, are questions at present receiving much attention, and as this subject is well worth some study on the part of all who are interested in the production and use of the grain, we propose to offer a contribution to its elucidation, premising that, like the other problems of barley growing, this is a complex one, and we do not pretend to an exhaustive treatment of it.

The malting barley generally—in the majority of districts almost exclusively—grown throughout the United Kingdom until recently has been the narrow-eared, two-rowed *Hordeum distichum*, which is now commonly called “Chevallier.” How much of it is descended from the particular grain to which this name was originally given it is impossible to say. We are indebted to Mr. J. B. Chevallier, of Aspsall Hall, Suffolk, for a copy of a letter written by his grandfather, the Rev. John Chevallier, in which the origin of the variety is thus set forth :—

A labourer [named Andrews] living in a cottage of mine at Debenham, in this county, as he passed through a field of barley plucked a few ears, and on his arrival home threw them for his fowls into his garden, and in due time a few of the grains arrived at maturity, and as the ears appeared remarkably fine I determined to try the experiment of cultivating them.

Chevallier<sup>1</sup> barley was therefore started by selection. It was not an importation from abroad, the product of many generations of special climatic or soil conditions, nor was it an artificially produced hybrid. It was not even the progeny of a single grain or of a single ear. It was a selection from an already-existing type of grain, common to the district and to the country at large. To the best of our knowledge all the other sorts of narrow-eared barleys of the same general type as Chevallier and the grain from which it sprang were originally produced until quite

<sup>1</sup> We have ventured to amend the usual spelling (Chevalier) to correspond with the name of the original grower.

recently by selective methods only. They have, however, by careful re-selection on the part of expert seedsmen and others, acquired certain minor, but doubtless useful, distinct habits of growth.

But even before the time of Chevallier there was another type of two-rowed barley grown in England, of which there were many sorts. By some botanists it was given the dignity of a species and named *Hordeum zeocriton*.<sup>1</sup> One sort was commonly known as Italian or Fluckwheat, another as Sprat, Fan, Peacock, or Battledore barley—names mostly suggested by the short and wide shape of the ear, sometimes tapering towards the top, and with more or less spreading awns—and it was figured or described by Lisle, Brown, Low, Sinclair, London, Morton, Wilson, and other agricultural authorities of this and the last century. Lisle's account of its characteristics is, like all his observations, exceptionally interesting.<sup>2</sup> The grains of the ripe ear were set at a different angle from those of the many varieties of *H. distichum*, and corresponding to this difference of angle, the rachis itself was shorter and the intervals of the points of attachment of the grain less.

How the various forms originated we cannot now tell. We are of opinion that natural or accidental cross-fertilisation of cultivated barley rarely if ever occurs. The artificial process is one of extreme difficulty and delicacy. Normally the glumes which enclose the flower of barley open sufficiently to allow the stamens to protrude, although they are frequently caught, so to speak, in the act of escaping by the reclosing glumes, and it may be noted that this is a peculiarity of some varieties. But to the best of our belief, from observation and the opinions of others, fertilisation has already taken place before the complete or partial escape of the stamens. And, although air-borne pollen-grains may be likely enough to gain access to the styles of other florets than those of their parent plants, it is not probable that actual crossing takes place.

We have grown Chevallier and Goldthorpe, the latter a

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<sup>1</sup> Mr. G. T. Hill, of the British Museum, has kindly traced for us the origin of the word "*zeocriton*," or more correctly "*zeocritthon*" (apparently derived from *zeú* = spelt, and *κριθή* = barley), to an old German writer, C. Bauhinus, who first used it. *Theatr. Botan.*, p. 22 (1623).

<sup>2</sup> *Observations in Husbandry*, by E. Lisle, Esq., late of Crux-eaton in Hampshire, 1757, p. 175. "Mr. Clerk, of Leicestershire, informed me that sprat or battle-door barley required a good, strong land; that its peculiar property was that it would not run up to a length of straw, though in good land, so as to lodge, as other barley would; and that it had a stronger and more pithy straw, but not so good for fodder." Several other writers of his time are quoted by Lisle to the same effect.

wide-eared variety (but with ears less tapering and awns not so widely spreading as some of the older wide-eared sorts), adjoining each other in two different seasons and never observed any intermediate types, although they were carefully looked for. It is conceivable that the difference between the shape of the ear in Fan or Sprat and Chevallier barley respectively may have arisen after many generations under particular conditions, but there is no direct evidence as far as we know that this is the case, and we are probably right in ranking the wide-eared barley as at any rate a sub-species of *Hordeum*. At present the best representative of this type is Goldthorpe,<sup>1</sup> named after the place of its origin; where, as the original grower, Mr. Wm. Dyson, has informed us, it was started from a single ear found in a field of Chevallier, no other ears of similar character being noticed in the field. Whether this particular ear was a "sport," or was seeded by an accidentally present grain of one of the older wide-eared sorts, is a question which cannot be answered. There is no doubt that Goldthorpe has grown "true to sort" since its introduction, and the practical question of importance is whether it and the other varieties of similar type, of the origin of which we have no precise information, are of equal value for malting purposes to those of the Chevallier type. We think that the wide-eared barleys will certainly not supplant the Chevalliers, and that they show a greater tendency to deterioration. All varieties of grain doubtless deteriorate under certain conditions, but it is certainly true in respect of Chevallier types that the reverse frequently occurs, and that, speaking generally, the quality of this type has been fully maintained, if not improved, during recent years.

There is no doubt that the objection to the wide-eared barleys on the part of many maltsters and brewers arises mainly from the fact that they do not usually "work" with Chevalliers, and some inconvenience is thereby caused when large bulks have to be mixed for storage. On the other hand, they are liked in many districts, and have been very successfully grown in Yorkshire during the last few years. The appearance of the grain is generally distinct, the husk being looser and thicker than with Chevallier, so that whilst very few even of the most expert judges would be sure on inspection to which particular "sort" a barley of Chevallier type belonged, the wide-eared

<sup>1</sup> The form of the ear in Goldthorpe closely resembles that described and figured by Körnicke (see note on p. 191) as *H. distichum*, var. *erectum*, Schübl. The same or a similar variety had, according to Körnicke, been also named *H. pseudo-zeocriton*. Following Linnæus and treating the wide-eared barleys collectively as a sub-species we have retained the earlier name, *H. zeocriton*.

barleys, now commonly called Goldthorpes, are generally distinguishable from Chevalliers, even after threshing.

Well matured samples of Goldthorpe barley are found to "work" evenly and freely on the maltsters' floors, but undoubtedly the special merit of the wide-eared type of barley is a stouter straw and consequent ability to stand up under weather conditions which would "lodge" Chevallier. This is a quality of the utmost importance to the grower, for which he will in his own interest often sacrifice some other qualities, but it will probably take some years to demonstrate whether, or on what particular soils, the wide-eared types now in cultivation are the more profitable in the long run.

Professor Maercker, of the University of Halle, lately communicated to the Institute of Brewing a very interesting paper<sup>1</sup> on barley, describing a series of experiments carried out at Lauchstadt for several years, with a view to demonstrate which were the best varieties for the different soils on which barley was commonly grown in Germany. As the result of these experiments he was of opinion that whilst Chevallier was the best variety for good barley soils, that is to say for soils which under good climatic conditions could be relied on to produce a well-matured grain, and whilst it also generally gave better crops on German soils than Goldthorpe, yet the latter variety was more suitable for strong land because it was less susceptible to the ill effects on quality of too good "condition" of soil, and did not produce under these conditions so nitrogenous a grain.

The percentage of nitrogen contained in barley cannot of itself be taken as a criterion of malting value. We shall have much more to say on the nitrogen content of barleys grown under comparable conditions. The nitrogen content of barley varies from 1.0 to 2.0 per cent. of the grain (corresponding to about 6.5 to 13.0 per cent. by weight of nitrogenous substances), and it varies with every season and with every different character of soil. It is impossible to lay down any fixed percentage which will correspond to good quality in all barleys. Moreover, as the greater part of the nitrogenous matter is in the form of permanently insoluble substances, it is not so much the total nitrogen which is of importance to the maltster and brewer, but rather the character of the nitrogenous matter which, after malting, is soluble in the mash tun. Notwithstanding what has been said above, there is, as we shall show later, a very clear relation between the nitrogen content of the grain and its ultimate maturation, *when barleys grown*

<sup>1</sup> *Journal of the Federated Institutes of Brewing*, vol. 7., p. 497.

under the same conditions of soil and season are compared together, and if a prolonged series of trials should demonstrate that it is a characteristic of one type of barley to give grain of low nitrogenous content as compared with other varieties under the same conditions, we should expect this type to give the more "mellow" grain. That a low nitrogen content is not invariably distinctive of Goldthorpe barley is shown by a considerable series of experiments by another continental authority, to be referred to later on.<sup>1</sup>

A variety of *H. distichum* called "Hanna" barley was considered by Professor Maercker to be best suited for the lightest German soils. Of this he has kindly sent us a sample. It is rather small in grain, greyish in colour, but well matured, and, according to Professor Maercker, ripens a week earlier than Chevallier.

Archer's "Stiff Straw," a hardy barley of Chevallier type, is a variety which has been much grown of recent years. The ear does not come out of the flag so far as with the true Chevalliers, and it is stouter in the neck. We believe it is rather later, however, and does not mature quite so well in consequence when spring sown. It, or a similar sort, has been to a considerable extent tried in the Eastern counties for autumn sowing, and this practice has given excellent results as to quality, in consequence of the earlier maturation of the grain. On lighter soils in Wiltshire the practice has not answered so well, except in one or two exceptional cases, the yield being generally low, especially after wheat. Moreover, autumn sown barley suffers greatly from the depredations of birds because it ripens earlier than other grain. There is the further difficulty of finding a place for it in crop rotations unless it takes the place of wheat. It does best after a fed-off crop, but obviously cannot be grown after winter-fed roots.

Another kind of two-rowed barley is grown in several Eastern counties. It is commonly known as "Ouchak" barley. The ear is of the same general structure as *H. distichum*, that is to say, it is a long, narrow spike, but the grains are very much longer than those of Chevallier. At first sight it may be mistaken after threshing for six-rowed barley, but the grains of six-rowed barley are quite distinct in shape, especially those of the lateral rows.

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<sup>1</sup> If two varieties have differing proportions of husk for grain of equal size (as in the case of Goldthorpe and Chevallier), some small allowance must be made in comparing their nitrogen content on this account, but, as will be shown later, differences in this respect are very small compared with those due to other conditions.

Corresponding to the two types or sub-species of two-rowed barley there are two comparable types of six-rowed barley, both of which when grown in suitable climates yield the malting material commonly known as "brewing" barley, to distinguish it from "Chevallier." *Hordeum vulgare*, the common English winter barley, grown here only for feeding, is one; and *Hordeum hexastichum*, recently reintroduced in some parts of England as a winter barley, is the other. In two-rowed barley there are also six rows of florets, four of which are, however, barren; one barren floret being inserted on the "rachis" or floral axis on either side of each of the fertile ones. In *Hordeum vulgare* these lateral florets are fertile and produce grain. If the four rows of lateral grains are stripped from an ear of *Hordeum vulgare* the remaining two rows correspond to the two fertile rows of *Hordeum distichum*, as is shown in fig. 1 (p. 192). The angle which the fully developed median row of grain makes with the rachis is approximately the same in *Hordeum vulgare* and *Hordeum distichum*, viz., about 20 degrees, and the intervals between the spikelets or groups of three florets are of about equal length, varying somewhat with the luxuriance of the growth, and being rather longer in a long-strawed, coarsely grown plant.

The same likeness in respect of the shape of the ear is observable between the two wide-eared types or sub-species, *Hordeum zeocriton* (two rows fertile and four infertile), and *H. hexastichum* (six rows fertile). This is illustrated by fig. 2. There are variations in other respects, of course: black-husked barley, barley with non-adherent husk, so called skinless, also grain without awns and with awns which fall off. But apart from the fact that the "fancy" sorts are not at present to any extent useful, these variations all probably arise within the four groups above referred to; and we think it would conduce to clearness if the many different sorts now cultivated were referred, when being described, to one of the four above-mentioned sub-species.<sup>1</sup>

<sup>1</sup> Note on the Classification and Nomenclature of Barley.—Notwithstanding that there is much confusion amongst English writers as to the nomenclature of barley, we have considered it best to retain the Linnæan botanical names in general use in describing the varieties in cultivation in this country. An almost entirely new arrangement of the whole genus *Hordeum* has been introduced by F. Körnicke (*Handbuch des Getreidebaues*, Berlin, vol. i., 1885, pp. 129–191). He adopts *H. vulgare* as a specific name to include the whole of the cultivated varieties (for which the group name *H. sativum* had hitherto been used) and also a wild form found in many parts of the East. He divides the species into four sub-species, *H. hexastichum*, L.; *H. tetraastichum*, Kcke. (*H. vulgare*, L.); *H. intermedium*, Kcke.; and *H. distichum*, L. He further divides these sub-species into forty-four

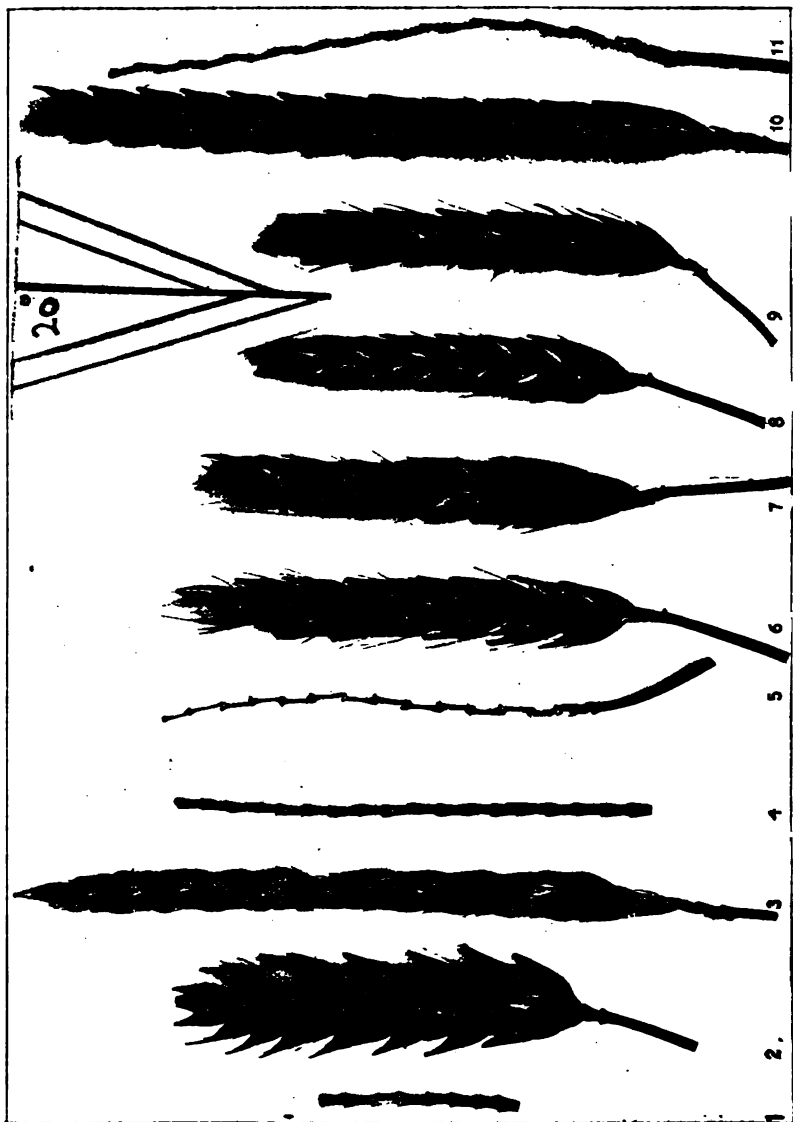


FIG. 1.—Ears of *Hordeum vulgare* and *Hordeum distichum*, with awns removed.

1. Rachis of *H. vulgare*. 2. Ear of *H. vulgare*, with median row of grain uppermost and lateral rows to right and left. 3. Ear of *H. distichum* in the same position; the infertile lateral florets can be seen on one side. 4. Rachis of *H. distichum*. 5. Rachis of *H. vulgare*, edgewise. 6. Ear of *H. vulgare*, with lateral rows of grain uppermost. The two lateral rows are sometimes more compressed and partly overlap, so as to appear like a single row as at the top of the ear in the figure. This has led to the use of the terms four-rowed or four-chested barley. 7. The same, with the lower lateral grains removed on the uppermost side. 8. The same, with all the lateral grains removed. 9. Ear of Ouchak barley. 10. Ear of *H. distichum* in same position as 6, 7, 8, and 9. 11. Rachis of *H. distichum*, edgewise.

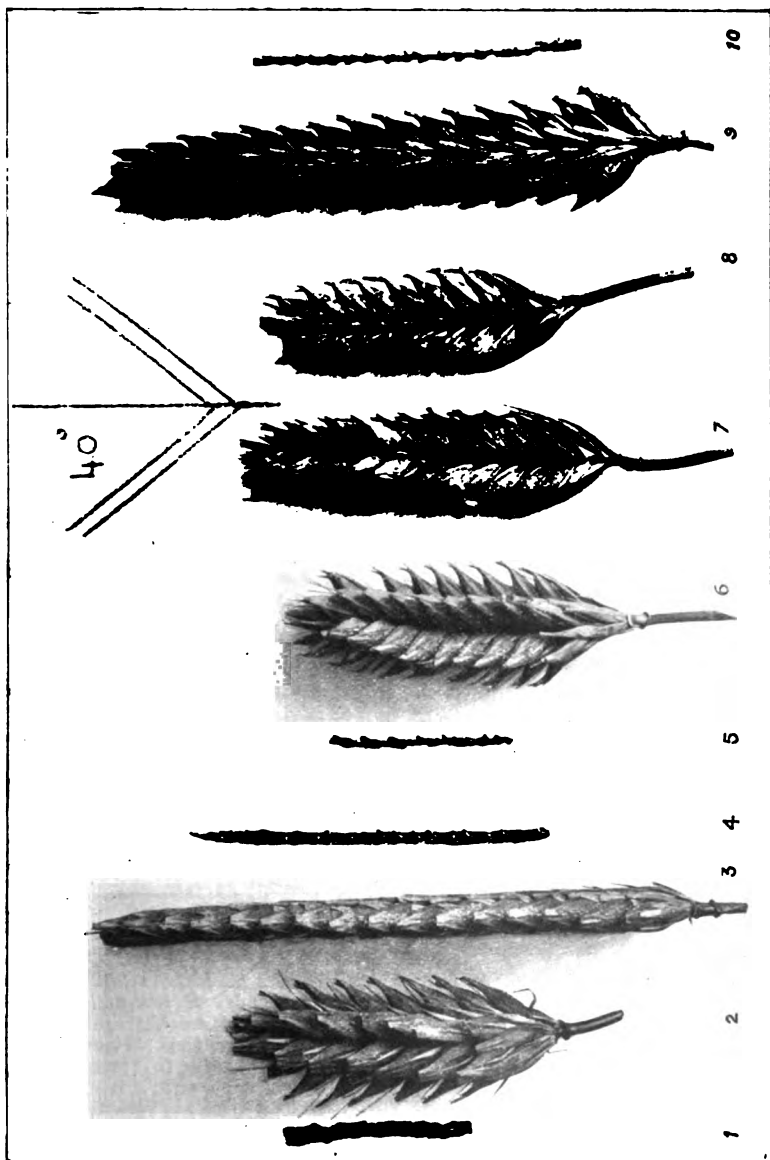


FIG. 2.—Ears of *Hordeum hexastichum* and *Hordeum zeocriton*, with awns removed.

1. Rachis of *H. hexastichum*. 2. Ear of *H. hexastichum* (not quite ripe), with median row of grain uppermost, slightly turned to the left. 3. Ear of *H. zeocriton* in same position; the infertile lateral row of florets can be seen on one side. 4. Rachis of *H. zeocriton*. 5. Rachis of *H. hexastichum*, edgewise. 6. Ear of *H. hexastichum* with lateral rows of grain uppermost. 7. The same, with lower lateral grains removed on the uppermost side. 8. The same, with all the lateral grains removed. 9. Ear of *H. zeocriton* in same position as 6, 7, and 8. 10. Rachis of *H. zeocriton*.

Which is the oldest type of barley? In the British Museum there are a number of ancient coins, on which ears of barley are depicted. We have, through the courtesy of Mr. G. T. Hill, of the Department of Coins and Medals, received casts of a large number of these. Those which show the most detail, and at the same time very beautiful and careful design, are from Metapontum, in South Italy, and date from between 600 B.C. and 300 B.C. They evidently portray wide-eared, six-rowed barley, and on photographing the coins and ears of *H. hexastichum* side by side, there appears a close resemblance in the shape of the ears and in the angle between the grains and the rachis. Fig. 3 represents the oldest of the Metapontum coins. There is also one British coin of Cunobelin struck at Camelodunum (Colchester) about the beginning of the first century B.C., the "obverse" of which is occupied by an ear of barley. The design is much less careful than that of the Metapontum coins, and is somewhat diagrammatic; but we think there is no doubt that it also represents wide-eared barley, though in this case that of the two-rowed variety (fig. 4). We have received from Dr. Hans Schinz, of the University of Zürich, a paper by the late Professor Oswald Heer, which contains a number of most carefully executed figures of ears and grains of barley which were found by him when excavating the lake dwellings of Robenhausen. They have been previously referred to by the writer of the article on barley in the "Encycl. Britt.," and also by Mr. H. Stopes in "Malt and Malting."<sup>1</sup> They are unmistakably wide-eared barleys. We have further received from Dr. Messikommer, of Wetsikon, Canton Zürich, a colleague of the late Professor Heer, a number of actual grains of barley found in the lake dwellings. They are all carbonised. Under what conditions this happened appears doubtful, but the

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varieties, of which only the four which we have described are in general cultivation in this country. Eight are described under *H. hexastichum*, one of which is "naked" and the others for the most part are distinguished by their colour or the forms of some of the floral appendages. Fourteen are similarly classed under *H. tetrastichum*, Kcke. (*H. vulgare*, L.) (nine naked). Of *H. intermedium*, Kcke., there are two rare varieties with awns only on the median rows. Lastly, under *H. distichum* he gives twenty varieties, one of which—*H. distichum*, var. *spontaneum*, Koch—is the wild growing variety above referred to, and which Körnicke considers to be the original form. Chevallier and similar narrow-eared sorts are in Körnicke's nomenclature *H. distichum*, var. *nutans*, Schubl., and the wide-eared sorts are *H. distichum*, var. *erectum*, Schubl. (with parallel ears very similar to Goldthorpe), and *H. distichum*, var. *zeocrithum* (with tapering ears and spreading awns like our old "fan" barley). Körnicke's work is of truly encyclopædic character, and should be consulted by all who are interested in the botanical classification of the many rarer varieties of barley.

<sup>1</sup> *Malt and Malting*, H. Stopes. Footnote to p. 65.

ancients were apparently accustomed to roast barley for use as food. The grain is short and plump in shape, and at first sight looks like "naked" barley, but Dr. Schröter, of the Museum of Zürich, where Dr. Heer's original specimens of ears are preserved, informs us that he is of opinion that this is not the



A

FIG 3.



B

A. Silver coin of Metapontum, South Italy, about B.C. 580-480.  
B. Wide-eared six-rowed barley (*H. hexastichum*, L.; *H. hexastichum*, var. *pyramidatum*, Kcke.) with awns cut short on lateral rows and removed from median row.

case. Professor Heer suggests that if the existing sub-species have a common origin, then the *H. hexastichum* of the lake dwellings is the probable ancestor of the other types, for it is more likely that improved cultivation has resulted in the lengthening of the ear than the reverse. He mentions the finding of one



A



B

FIG. 4.

A. Gold coin of Cunobelin struck at Camelodunum (Colchester), about beginning of first century, B.C.  
B. Wide-eared two-rowed barley, Goldthorpe (*H. zeocriton*, L.; *H. distichum*, var. *erectum*, Schubl.; *H. pseudo-zeocriton*, Metzger), with awns cut short.

ear of two-rowed barley, which, however, was unfortunately lost, and which he considers to have been rare in this age. It seems probable that the infertile florets of six-rowed barley were originally fertile, and some of the older agricultural writers say that two-rowed barley will degenerate into six-

rowed grain under adverse conditions.<sup>1</sup> On this point we have no direct evidence available. On the other hand, it must be said that Körnicke, who has probably given more study to the matter from a botanical point of view than anyone else, is of opinion that the wild-growing *H. distichum*, var. *spontaneum*, Koch, is the parent form. We have not ourselves seen the plant. It is described by Körnicke as having long and narrow ears, and he disagrees with an earlier writer (Koch) who originally described it, and who considered that it resembled *H. zeocriton*. Körnicke, however, gives as the most prominent characteristic of the wild-growing variety the fragility of the rachis. As the grain ripens the rachis breaks at the internodes. Now it is noteworthy, though not mentioned by Körnicke, that this fragility of the rachis is frequently seen in the wide-eared cultivated barleys. In samples of Goldthorpe it is much more common than in samples of Chevallier to meet with grain with segments of the rachis adherent to the grain after threshing, and we are of opinion that, although thicker, the rachis of the wide-eared grain is distinctly more easily broken than that of the narrow-eared sorts. On the whole the evidence seems to us to point to the greater antiquity of the wide-eared forms. But on a subject wrapped in such obscurity it is needful to speak with reserve, for barley is almost without doubt the oldest of our cultivated plants.

If the foregoing surmises are correct, it is an interesting question as to whether improvements or the reverse are likely to arise from hybridisation of more developed with less developed types. We are under the impression that breeding back to original types usually increases the vigour of plants, whilst "in-and-in" breeding, on the other hand, develops specific points; but we shall content ourselves with suggesting this as a matter very suitable for investigation, and we believe that the Messrs. Garton of Warrington, whose experiments in cross-fertilisation have attracted so much notice, have already given attention to it.

Cross-fertilisation may introduce innumerable intermediate varieties of barley, just as it has done with wheat and all other cultivated plants on which it has been practised. Messrs. Garton have, we believe, been the first to succeed with barley, and at present there are two varieties, "Standwell" and "Invincible," both of which are crosses, the former intermediate between Chevallier and Fan barley (*H. distichum* and *H. zeocriton*), but

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<sup>1</sup> General Report on Agriculture, &c., of Scotland. Sir John Sinclair, Bart., President of Board of Agriculture, &c., 1814. Vol. i., p. 495.

tending more, as far as our observations go, towards the wide-eared type; and the latter a Chevallier with a strain of "Standwell" in it and nearer in character to Chevallier. There is room for some doubt as to whether cross-fertilisation will produce as good results in the case of barley as with other plants, or even as with other cereals, but it is too soon to speak with confidence on the matter, and everyone acquainted with the results obtained by Messrs. Garton with the other cereals, especially oats, will hope they may be equally fortunate with barley. In any case, as new varieties frequently ripen, mature, and "work" differently, it is most desirable that they should be kept apart, especially for seeding.

Messrs. Garton have further announced that they propose to introduce a six-rowed Chevallier barley—that is, a cross which produces six rows of grain of the shape of Chevallier. It is a matter not to be overlooked, however, that a six-rowed ear is hardly likely to have as plump and well-shaped grains as a two-rowed one, owing to the greater crowding together of the grains. There are some points in which six-rowed grain has an advantage. It is on account of these that it is so largely imported, but it has to be remembered that its value per quarter is, on an average, 30 per cent. less, weight for weight, than Chevallier. This consideration may not apply if the shape of the grain can be maintained.

On the other hand, there is no doubt that larger and heavier grain can be produced by crossing two-rowed varieties, but size of grain is not the only, or indeed, the first, consideration in respect to quality. If crosses between such distinct types as Chevallier and Goldthorpe can be got to combine the good qualities of both, a step forward will be made; barleys, that is, which are as thin in the skin and as kindly as Chevalliers, but at the same time stiffer in the straw, and not lodging so readily when the crop is heavy. The grain of those above referred to is generally bold, and heavy yields are common. They have not yet been long enough in cultivation for a judgment to be formed on their merits in other respects.

It seems most desirable, in view of probable developments in the production of new varieties by cross-fertilisation, that full discussion should take place on the question of the qualities which are best to aim at, especially when it is remembered that heavy straw and coarse grain frequently go together. In this connection the researches of some well-known Continental authorities on malting must be referred to.

## 3. RECENT RESEARCHES ON COINCIDENT RELATIONS BETWEEN SIZE OF GRAIN, MATURATION, AND NITROGEN CONTENT.

For some years past W. Johannsen, of Carlsberg,<sup>1</sup> has conducted a series of trials which were designed to show whether by selection the size of the grain could be maintained and increased without increasing the nitrogenous bodies, and he chose Goldthorpe as the variety to test in this respect.

Some very important considerations in respect of the relation between size of grain, maturation, and nitrogen content, which we have been investigating for the past five or six years, have a distinct bearing on the results obtained by Johannsen.

Johannsen endeavoured, by various selections from Goldthorpe barley over five years, to produce a grain with increased size and lower total nitrogen content. He first gives a preliminary experiment designed to determine the best way of selecting the samples. His figures show that the grains are heavier at the base of the ear and diminish in size towards the top, and that the larger grains at the base have a slightly lower nitrogen content than the smaller ones towards the top :—

—	Weight per 1000 corns	Per cent. total nitrogen
	Grammes	
Grains from base of ears .	61·71	1·40
“ “ centre, one side	58·66	1·42
“ “ “ other side	58·92	1·43
“ “ top of ear .	47·63	1·46

We are able to compare these figures with determinations upon grain selected in a similar way from ears of Chevallier barley grown in 1897 :—

## TWENTY-FIVE EARS CHEVALLIER BARLEY.

—	Weight per 1000 corns	Mealy corns per 100	Total nitrogen per cent. of grain
	Grammes		
Grains from base of ears .	50·1	34	1·50
“ “ centre of ears	50·0	31	1·51
“ “ top of ears .	42·3	29	1·53

It will be noted that in both cases the larger corns have a slightly lower nitrogen content than the smaller. The reason for this is probably as follows :—The smaller the grain the greater is the proportion of “outside” or envelopes.

<sup>1</sup> *Résumé du Compte-rendu des Travaux du Laboratoire de Carlsberg*, tome 4me, pp. 122–92. Abstract in *B. T. Review*, Nov. 1899, p. 347.

The pericarp, the "tegmen" (ovular integument or seed-coat), and the aleurone layer of the endosperm are, taken together, richer in nitrogen than the starch-containing cells of the endosperm. This is shown by numerous analyses, by many observers, of the bran of wheat which corresponds to these structures. In ripe barley the pericarp and tegmen are extremely thin. The aleurone layer is relatively thick, but varies considerably. There is no doubt whatever as to the high total nitrogen content of the aleurone layer. That the same applies to the pericarp in early stages of growth, when it can be easily dissected, is shown by the following, from one of a long series of analyses made by us of 1897 growing barley:—

GOLDTHORPE BARLEY, 1897.

Date	Dry matter in 100 grammes barley	Total per cent. of dry matter contained in, respectively			Total nitrogen per cent. of dry matter of, respectively		
		Paleæ	Pericarp	Endosperm	Paleæ	Pericarp	Endosperm
July 3	Grammes 31·9	36	30	34	·61	1·65	1·28
" 6	34·4	28	32	40	·57	1·81	1·32
" 12	39·4	18	20	62	·58	2·05	1·03

It is true that the outermost of all the envelopes of the grain, the paleæ or husk, is less nitrogenous even than the starch-containing cells. The nitrogen content of dry ripe husk is only about 0·5 per cent., but of course the weight of the husk is small. Putting the above two considerations together, the higher nitrogen content of the smaller barley probably is due to higher proportion of pericarp and aleurone layer. Whilst on the one hand the inner envelopes are richer in nitrogen than the starch-containing cells, and on the other hand the husk is less rich, it will be found that in all grain except the screenings, where the proportion of non-nitrogenous husk is very excessive, the nitrogen content of the combined envelopes, i.e. husk, pericarp, tegmen, and aleurone layer, is higher than that of the starch-containing cells. This is shown by the following nitrogen determination made by us on barleys of different growths of 1895 crop:—

—	Total nitrogen of grain	Nitrogen per cent. of fine flour of grain
1. Fine English (mellow) ( <i>H. distichum</i> ) . . . . .	1·89	1·18
2. " (not so mellow) ( <i>H. distichum</i> ) . . . . .	1·58	1·37
3. Inferior English ( <i>H. distichum</i> ) . . . . .	1·57	1·33
4. Chevallier Californian ( <i>H. distichum</i> ) . . . . .	1·64	1·37
5. Brewing Californian ( <i>H. vulgare</i> ) . . . . .	1·48	1·31
6. Danubian ( <i>H. vulgare</i> ) . . . . .	2·04	1·97

The fine flour comes almost wholly from the starch-containing cells, and it is invariably lower in nitrogen content than the whole grain (the difference being least in the Danubian, which is by far the most husky grain), but as the starch-containing cells form much the largest part of the entire grain, it is obvious that the combined envelopes must be richer in nitrogen than the whole grain and much richer than the starch-containing cells.

The bearing of these facts on the research of W. Johannsen is so far confirmatory of his preliminary experiment, which shows that large grains have lower relative nitrogen content than smaller ones, *when they are graded according to their position on the ear and when, therefore, they may be supposed to be very nearly equally matured*. If, then, any given sample of barley is evenly grown and matured, we should, *prima facie*, expect on grading it to separate the smaller corns at the tops of the ears from the larger ones at the base, and to find that the larger ones were the less nitrogenous.

But samples of barley even from limited areas are very seldom uniform in respect of maturation. The differences between ears are much greater than between differently placed corns on the same ear. As a matter of fact, we have found that when samples of barley as commonly met with are graded, more often than not the *largest* grain is the *most* nitrogenous and the worst matured. In one case determinations were made on a large sample from one of the 1897 Rothamsted plots, viz., that manured continuously with rape cake and superphosphate (Plot 2c of Hoosfield). These plots are comparatively small and apparently very uniform. Other samples (of 1898 and 1899 barleys) gave similar results:—

*Barley from Plot 2c, Hoosfield, Rothamsted, 1897. Sample graded by screening.*

Grade	Weight of 1000 corns	Mealy corns per 100	Total nitrogen per cent. of grain
	Grammes		
No. 1 . . .	50.6	66	1.39
No. 2 . . .	41.0	76	1.23

*Barley from a Field of several acres, Wiltshire, 1898. Graded by screening.*

No. 1 . . .	51.0	29	1.30
No. 2 . . .	41.6	69	1.18
No. 3 . . .	29.1	66	1.19

*Barley from another Field, Wiltshire, 1899. Graded by screening.*

Grade	Weight of 1000 corns	Mealy corns per 100	Total nitrogen per cent. of grain
	Grammes		
No. 1 . .	52.5	32	1.16
No. 2 . .	41.7	51	1.06
No. 3 . .	36.0	65	1.04

We think it possible that in some seasons the larger grains may be the least nitrogenous and the best matured, but when we come to describe the long series of Rothamsted samples which we have lately examined and tested, there will be found to be a large body of evidence to show that comparatively small grain is, taking an average of seasons, that which is best in these respects.

So far only Johannsen's preliminary experiment (with grains from different parts of the same ears) has been discussed. We may now proceed to consider the record which he gives of the five years' results with Goldthorpe barley. Even to a more pronounced extent than in the determinations which we have made on graded samples, he finds that in each of the five years 1893-1897, the samples show with increased size of grain not lower but higher nitrogen percentage, all the samples being now taken from the centre of the ears. In the first year, 1893, as the accompanying table shows, a sample com-

Weight of 1000 corns	Per cent. of nitrogen	No. of samples
Grammes		
48.8	1.21	1
53.9	1.32	3
58.3	1.51	12
62.1	1.61	50
66.1	1.72	19
73.2	2.00	1

posed of grains weighing 48.8 grammes per 1000 gives 1.21 per cent. total nitrogen; another sample weighing 73 grammes per 1000 gives 2 per cent. total nitrogen. The following years show similar results, nitrogen percentage generally *increasing* with size, and this notwithstanding that selections were made, for sowing, of grain with low nitrogen percentage in proportion to size. A nitrogen content of 2 per cent. is very high. We have only met with it in very low-type, badly matured barleys, such as South Russian or Danubian. Barleys weighing from 60 to 70 grammes per 1000 are very rare in ordinary cultivation, and are nearly always of coarse quality.

Such barleys as in this country take prizes at exhibitions of malting barley weigh generally between 40 and 50 grammes per 1000 corns.

We think that the ears bearing the excessively large and heavy grain of some of Johannsen's samples must have been grown with very sparse seeding, *i.e.* with great relative air and soil space for individual plants, for it is frequently observed that, at the extreme edge of a plot adjacent to an uncropped strip of land, large-eared and large-grained corn is developed with a high nitrogen content; but such barley is very hard and steely, does not mature in due season, and finally yields a coarse grain. We shall later on give some determinations made upon barley of this class.

Figs. 5 to 10 (pp. 204-5) are micro-photographs of sections through (figs. 5 and 6) half-ripe, (figs. 7 and 8) coarse, large, ill matured, and (figs. 9 and 10) ripe, kindly, small grain respectively, and also still-more-magnified sections from the same part of the envelope of such grains. As between the half-ripe and the other grains, the collapse of pericarp into a mere membrane, the compression of the tegmen or seed coat, and the marked development of the double and sometimes triple layer of aleurone cells, can be easily traced. As between the coarse and the kindly grain there may be noted the thicker husk and the somewhat thicker aleurone layer of the former; also, by comparing the three sections in respect of the layer of starch-containing cells immediately underlying the aleurone layer, marked differences can be seen in the original photographs. This part of the grain has been recently described in full by another well-known investigator, J. Gruss,<sup>1</sup> who regards it as the special storehouse of "reserve albumin." It is apparently transitional, both in shape of cell and character of contents, between the inner much-elongated starch cells and the aleurone layer. Now, large, heavy, coarse grains have more "reserve albumin" in the outer cells of the endosperm, and indeed more nitrogenous matter in every part of the seed. With such grain not only are the nitrogenous envelopes unduly thick, but the starch-containing cells, making up the larger part of the grain, have also a high content of nitrogenous matter.

Considering the progress of Johannsen's experiment during the five years, and averaging his figures for each of the years, we get the following:—

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<sup>1</sup> *Wochenschrift für Brauerei*, 16, 532. Abstract in *Journal Society of Chemical Industry*, xviii. p. 1143.

Year	Weight of 1000 grains of barley in grammes	Total nitrogen per cent.
1893	62.1	1.61
1894	53.7	1.48
1895	42.6	1.49
1896	56.0	1.65
1897	51.4	1.60

These results show no definite relation between size of grain and total nitrogen content *in different seasons*, and this is to be expected in all experiments of this kind. It has been abundantly demonstrated at Rothamsted, over much more prolonged periods, that total nitrogen content of grain depends far more upon seasonal than soil conditions and varies with these within very wide limits, even with the same manurial conditions year after year. But when we find barleys of the *same* year and grown on similar soil increasing greatly in percentage of nitrogenous matter with size, we are warned that there is a limit beyond which it is not desirable to carry size of grain. Whilst neither the farmer nor the maltster wants thin, husky corn, the brewer as certainly does not want malt made from an abnormally large grain, if size has been obtained to the detriment of quality.

Although we have seen that the percentage of nitrogenous matter in barley will be determined to some extent by the ratio which the envelopes bear to the starchy endosperm, and whilst this will vary considerably in different seasons, it is not accountable for the wide differences which grain differently matured, taken in the same season and from the same field, will show in respect of percentage of nitrogenous matter. Ripening under favourable conditions is a process in which carbohydrate or non-nitrogenous reserve material is formed or stored up in the endosperm at a greater rate than nitrogenous materials also required as reserve. It is well known that the appearance of fractured grains gives indication of the character of the ripening and maturation. We have determined not only the total nitrogen, but also the nitrogenous matter of different solubilities, in the fractured halves of mellow and steely grains in many growths of barley. The table on p. 206 gives two such series of determinations.

The steely, *i.e.* badly matured, grain is always much more nitrogenous than mellow grain grown under the *same soil and seasonal conditions*. The differentiation of the nitrogenous matter of barley in respect of its varying solubility has been worked out by Dr. Osborne, of the Connecticut Agricultural

FIG. 5.

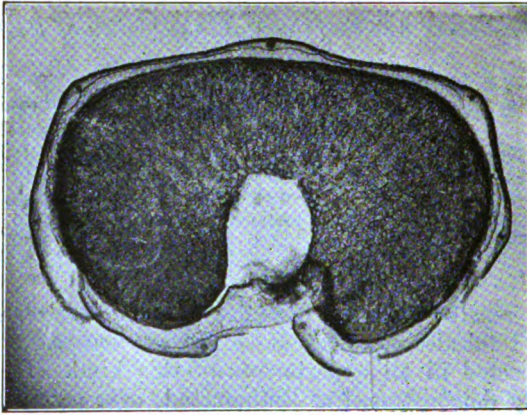


FIG. 7.

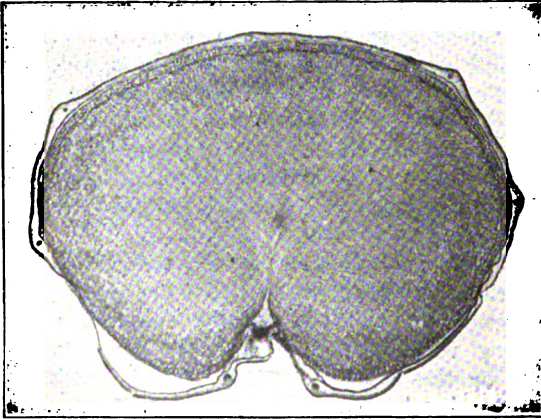


FIG. 9.

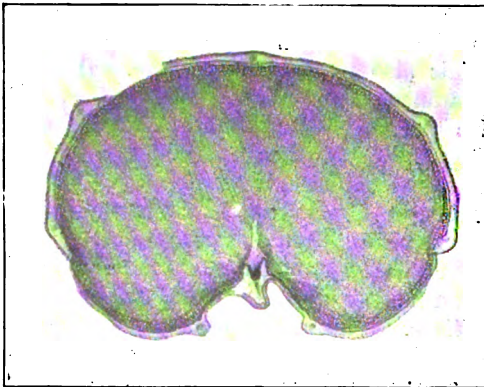


FIG. 6.

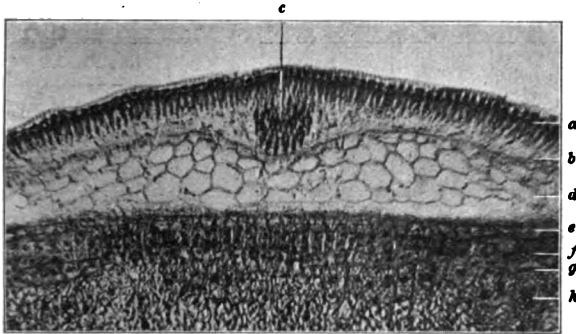


FIG. 5.—Median transverse section through about half-ripe grain ( $\times 16$ ).  
FIG. 6.—Portion of same from dorsal side, opposite furrow ( $\times 120$ ).

FIG. 8.

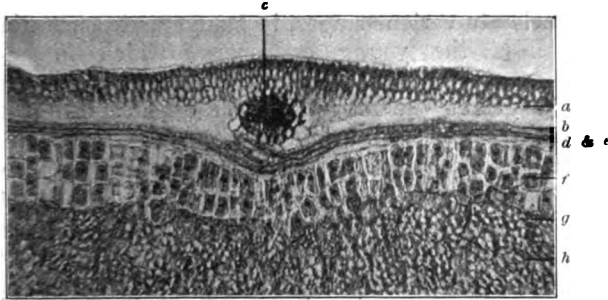


FIG. 7.—Median transverse section through large coarse grain,  
about 60 grammes per 1,000 ears ( $\times 16$ ).  
FIG. 8.—Portion of same from dorsal side, opposite furrow ( $\times 120$ ).

FIG. 10.

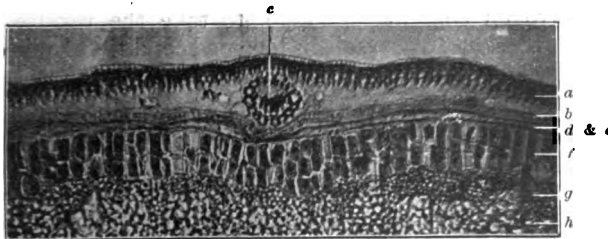


FIG. 9.—Median transverse section through small, well-matured grain,  
about 40 grammes per 1,000 ears ( $\times 16$ ).  
FIG. 10.—Portion of same from dorsal side, opposite furrow ( $\times 120$ ).

a. Outer palea.  
b. Inner palea.  
c. Vascular bundle.  
d. Pericarp.

e. Tegmen.  
f. Aleurone cells.  
g. Small polygonal starch  
and "reserve albumin"

containing cells under-  
lying aleurone.  
h. Elongated starch-con-  
taining cells.

	1896 BARLEY		1898 BARLEY	
	Per cent. of nitrogen	Per cent. of nitrogen	Per cent. of nitrogen soluble in 5 per cent salt solution	Per cent. of nitrogen soluble in 0.5 alcohol
Mellow corns	1.206	1.036	.335	.257
Steely corns, from same sample	1.512	1.456	.394	.463

Experiment Station, and whilst it is not at all probable that an absolute separation of the proteid matter is so obtained, there is no question that the different degrees of solubility indicated correspond to distinct differences in the character of such matters present.

In 1897 we made a long series of determinations upon green growing barley in various stages, in many cases separating the envelopes from the young endosperm, which is an easy dissection to accomplish in the earlier stages. There were marked changes in the ratios to each other and to the total nitrogenous matter of the differently soluble bodies. The salt-soluble bodies diminish as the ripening period approaches, and also during maturation. The alcohol-soluble substance increases in the earlier stages and afterwards diminishes. We have always found in steely barley a relatively high proportion of the latter.

Quality, apart from size, is almost wholly a question of maturation. Where, as on thin, poor soils in low condition and in droughty seasons, barley "goes off" and ceases to assimilate, that is to say, ripens, in the sense of being fit to harvest, without maturing, the grain is thin, hard, steely, and of low value. There has been premature or too quick ripening, and there is high nitrogen content. Where, to take the reverse set of conditions, there is strong soil in too good condition and weather favouring vegetation rather than seed formation, the result will be too prolonged ripening, the straw "holding out" instead of "going off." Heavy, coarse, often very large grain, also of high nitrogen content results, which, although giving more extract to the brewer than a smaller (and also coarse) grain, will not give as much as a smaller grain which is kindly and well matured, and will in respect of quality of extract give no better results than prematurely ripened material. In both cases there is indeed the same defect, deficient maturation, with its accompanying difficulties for the manufacturer, for such barley will not work into satisfactory malt. Typical

barley of the prematurely ripened sort is Chevallier Californian in some seasons, and, on the other hand, Irish barley is often of the latter kind. Needless to say, their appearance is as absolutely unlike as are the climatic conditions.

#### 4. PHYSIOLOGICAL ASPECTS OF MATURATION AND OF OVER-MATURATION.

We have used the term maturation so frequently, and so strongly urged it as a better criterion of value than size of grain, that it is desirable to define more particularly what is meant by it.

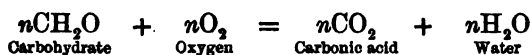
During the vegetative period the plant absorbs and assimilates materials supplied by the soil and the atmosphere, and the absorbed matters of comparatively simple chemical composition are elaborated into matters of more complex structure. From carbonic acid and water there are ultimately formed carbohydrates; and similarly with the nitrogenous matters, absorbed probably as nitrates, they are ultimately found as proteids. This matter, which is chemically more complex, is at the same time built up into definite structures in the plant—that is to say, becomes fixed temporarily or permanently in location, as, for instance, starch granules or cell-wall. But that portion of the starch and cellulose and proteid matter which is stored in the seed is so stored for a special purpose, viz., to provide for the first needs of the growing embryo. As soon as the embryo begins to grow there sets in, so far as the reserve matter of the seed is concerned, a reverse process. The complex matter becomes more simple, and structures like starch granules and cell-wall break down. Carbohydrates become soluble and in part break up into carbonic acid and water. If the seed gives life to a complete plant, the whole of the reserve matter undergoes this breaking-down process. When the grain is merely malted only the first stages take place.

Between the up-grade and the down-grade period there is ordinarily a resting-stage, which will be long or short according to the location of the seed in relation to moisture and temperature. We say there is “ordinarily” a resting-stage at this particular period, but there is no evidence, so far as we are aware, that this is an absolute necessity. Some grain which is unripe will grow under certain conditions, i.e. it must be partially dried before it is attempted to germinate it. There may be either no resting-stage, or a very short one, and that

not at the usual period. But these are abnormal conditions. They do not arise in a state of nature, because the seeds do not at that stage separate from the parent plant. When grain under cultivation is cut unripe it may grow very well, provided there are, first of all, drying conditions. But the grain is not only one, but two stages, from being "fit" for malting purposes. Grain will "grow" when it will not "malt." It has first to complete an intermediate stage, during which matter "migrates" from the stem upwards to the seed, and within the seed, from the endosperm to the embryo. It will then have reached full size, and all the material for malting be present in the grain, but the material will not be in the requisite condition. Something more is still required for complete "maturation."

The last stage is that change in the structure of the endosperm which results in the grain becoming "mellow." It then shows a white, mealy-looking fracture when broken, and, what is of importance, "malts" easily. Exactly what happens within the starch-containing cells has never yet been demonstrated. It is pretty certain that the change is not so much, if at all, in the starch granules as in the ground substance in which they are embedded. Starch is formed from granules of elaborated protoplasm called plastids, which are of various kinds; but all the protoplasm does not go to make starch, even in such a starchy structure as the endosperm of a barley grain, and the starch granules remain embedded in a kind of "matrix" of very composite character. It almost certainly is a change, either in the physical or the chemical structure, or in both, of this "matrix" which gives the difference between a mellow and a steely grain. To a considerable extent this alteration in structure may take place after the crop is cut provided the conditions are favourable.

There is a good deal of evidence to show that during the final stage of the process of maturation of an already ripe grain there is a slight loss of weight, and, if this is the case, it is the best proof that maturation is a post-ripening process. If the grain is very dry and remains so, nothing (as far as we know) happens, but if at this stage it takes up only a moderate amount of moisture, such as will be supplied by a few night dews whilst the crop lies in swath and drying conditions alternate, then we have good reason to believe that the breaking-down process, which is, roughly speaking, the same as that which goes on during the active growth of the seed, commences. Although this breaking down is much more complex than is there represented, the following equation illustrates what goes on :—



One reason for believing that at this stage, without actual germination, this process begins is that we have proved a loss of carbonic acid to take place during what may be called the process of partial artificial maturation known as sweating. But the extent of this change and loss is normally insignificant. From a number of experiments made some time since, we estimated that with a barley containing 14.0 per cent. of water, which is rather under normal in this country, the carbonic acid expired on drying for twenty-four hours at a temperature of 100° F. was about .02 per cent. of the weight of the grain. It is a fact well known to maltsters that grain which is *very* dry, such as some foreign barley containing only 11 or 12 per cent. of water, is not improved by further drying on a kiln. No maturation or mellowing takes place. English barley in ordinary seasons frequently contains after threshing 16 per cent. of water and sometimes more. Such grain is greatly improved as malting material by kiln-drying. We are at present investigating the question as to the precise conditions of moisture content and temperature under which the best results are obtained. A further very instructive line of research would be in respect of the changes, doubtless in the same direction, which take place under normal conditions in the stack.

The same process of maturation takes place with wheat, but there is this very material difference from the industrial point of view—that the miller does not want mellow or soft wheats, or at any rate not more than a certain proportion of them, for although they give him the whitest flour it is generally “weak.” It is interesting, however, to note—as has been pointed out to one of us by Dr. Sidney Williamson, who has made a special study of this point in connection with wheat—that in this grain the transition from hard to soft, corresponding to that from steely to mellow in barley, can be often seen on a superficial examination of the grain in the intermediate stage. Dr. Williamson has described wheat grains to us in this stage as “piebald.” The grain is, so to speak, speckled, the soft parts showing through the seed coats, and when such grains are cut the line of separation between the hard and soft parts is quite clearly defined across the starch-containing cells. Barley, at any rate the ordinary variety with adherent husk, does not give this appearance, but it would appear that the mellowing of the grain spreads from the neighbourhood of the cells underlying the furrow, that is from the median longitudinal axis

towards the outer part of the endosperm, which is the last part (particularly towards the apex) to become mellow. The difference between steely and mellow grain can be judged from its appearance by all who are familiar with malting barley, and can be further demonstrated in several ways, most easily by the well-known "Korn Prüfer" or cutting instrument described in our previous communication;<sup>1</sup> also by the difference in translucency of the grains when seen by ordinary transmitted light. Steely grain is translucent, probably because of the continuity of the cell contents; mellow grain is opaque. It occurred to one of us that possibly the Röntgen rays might also demonstrate some differences. On photographing, by means of the X-rays, grains of steely barley, mellow barley, and malted barley respectively, a rather striking set of appearances resulted. The photographs unfortunately cannot be reproduced by a block printing process on account of their faintness, for like other vegetable matter barley grains oppose very slight resistance to the rays. Whilst, however, the "radiograph" of the endosperm of steely grains appears quite uniform and structureless, that of mellow grain shows more or less numerous clefts or striations, as if the endosperm were split or discontinuous, and in malt the striations are so much more numerous as to amount to a network. It is probable that these are real air-spaces; at any rate we cannot account for the appearances otherwise, and if so there must be many more of them than show in the "radiographs," for only the spaces lying in planes passing through the source of light would be shown, and these would probably be but a small proportion of the whole. We must reserve further reference to this phenomenon except to say that these "striations" are much more numerous in barley grains originally steely which have been experimentally subjected to a process of artificial maturation in imitation of the natural process, in so far as that, being a post-ripening process, consists in alternate absorption of water and desiccation, as was suggested some years since by W. Johannsen, whose researches on the nitrogen content of barley have already been referred to. It is noticeable also that mellow grain has nearly always a lower specific gravity than steely grain of equal size, owing to the greater relative air space within the envelopes.

If we were required to give the briefest possible definition of the process of maturation we should describe it as a "commerce" of the ripe grain in water previous to germination and

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<sup>1</sup> Journal B.A.S.E. 3rd series, vol. viii. part i. 1897, p. 76.

during the resting-stage, that is, the alternate absorption and loss of water in such quantities and under such conditions as were not favourable to the starting of actual germination. This leads us to a consideration of the important subject of over-maturation.

Let us consider what happens to a seed under natural conditions, that is to say, to seed which after full ripening falls to the ground. Obviously everything depends on its location in respect of the three conditions for germination, viz., water, air, and warmth. Given all these, barley will germinate if fully ripe, even before separation from the parent plant. Seeds which fall to the ground may alternately absorb moisture and become dry again without germinating, but all this "commerce" of the seed in water is attended with chemical and physiological changes in the direction of germination. It is maturation under natural conditions, and, in the case of the wild-growing *Gramineæ*, it is without doubt over-maturation to the point of decay as regards probably a very large proportion of the seeds which are formed. Some seeds, like those of the *Cruciferae* (charlock is a well-known example), may either be undergoing this operation, or remain in the resting-stage, for a very long time, and may even be washed down into the subsoil, be retained there probably for years, and then on exposure to the air germinate. The structure of the seed of the cultivated cereals, however, is quite different. The seed coats are far less resistant, but it is worth noticing that barley seems to be provided with an envelope to the more starchy part of the endosperm, which affords greater protection than does that, for instance, of wheat. We refer to the aleurone layer immediately underlying the true seed coat. This in wheat consists of a single layer of cells, but in barley there are always two, and generally three or more, cells underlying one another.

Now, this is by far the most persistent part of the endosperm. Its structure survives the earlier processes of germination long after that of the inner starch cells has completely broken down, and even goes through the brewer's mash-tun intact, except where mechanically broken. It seems clear that it is a function of this structure to preserve the inner endosperm from the undue effects of moisture in the stages of maturation and early germination; its much greater thickness in barley than in wheat may be due to the ordinarily longer resting-stage of the former seed. This conjecture is strengthened by the fact which we have observed that the aleurone layer is frequently thicker in spring-grown corn than in the winter varieties.

There is room for much difference of opinion as to the precise degree of maturation desirable for malting barley. As a matter of fact in this climate the grower has little choice in the matter. The method of harvesting the crop is now very frequently to cut and tie with a "binder" and set in "stooks." We think that this is not nearly so likely a plan to give mellow grain as laying in swath. But a grower cannot afford to risk damage to the crop by delaying harvesting operations, so that it is almost wholly the character of the weather during the week before cutting and during the short period, often too short for good maturation, between cutting and harvesting, which settles the matter. Weathered barley is generally mellow—though not always, as we shall see later—but it loses weight by weathering and is seldom harvested free from grown corns, which of course greatly deteriorate its value.

Samples of barley are not very plentiful which will show more than 60 or 70 per cent. of "mealy" fractures when cut, unless they are more or less weathered. But when grain of good colour and kindly appearance shows something like this percentage it will generally be found that the process of mellowing has commenced in almost all the grains, that is, the centre of the grain is mellow. Such barley will generally malt well, especially after sweating.

On some of our plots at Warminster it is customary to make paths by removing the young plants round the edges after the top dressings have been put on. Even then it is necessary at harvest time to discard the outsides of the plots and re-measure the areas before weighing up the produce, because the plants at the extreme edges are very unduly developed owing to more air and soil space. The barley, especially of the outside drill, is invariably very strong and coarse. Last year we weighed up the grain and straw on a certain length of one of the outside, and, for comparison, of the two next inner drills at the time of cutting. We further left standing for a month from August 9 to September 9 (during which time the weather was very variable) a further length of one outside and the two next inside drills, to see what would be the effect of such extreme over-maturation. The figures tabulated on the opposite page show the character of the grain (1) at the time of cutting the crop, (2) after threshing, and (3) after a month's weathering.

The weight of both the grain and the straw on the one outside rank was nearly double that on both the two next ranks together. The grain of the outside rank never really matured, although it was badly weathered; and it is a fact that barley grown on over-strong soils will not become mellow even with

1. *Grain rubbed out from barley as cut August 9, 1899.*<sup>1</sup>

	Weight per 1000 corns <sup>1</sup>	Mealy corns per 100	Nitrogen per cent. of grain
	Grammes		
Outside rank . . . . .	57.5	27	1.58
Next two ranks . . . . .	51.7	36	1.37

2. *Grain harvested one week later and threshed November 1899.*

Remainder of plot . . . . .	51.7	67	1.32
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3. *Weathered grain from adjoining area to 1, cut September 9.*

Outside rank . . . . .	57.5	50	1.65 <sup>2</sup>
Next two ranks . . . . .	51.7	86	1.39 <sup>2</sup>

excessive weathering. We think that this points to the undesirability of very thin seeding (which is sometimes advocated) especially on strong soils. Most barley growers in good districts sow three bushels to the acre, and are of opinion that a moderately thick plant conduces to kindliness, though not to large grain. One of us remembers many years ago a neighbouring amateur farmer, on a piece of good land, drilling barley about fifteen inches apart in the rows, with the result that an enormous crop of straw was grown with excessively large grain of very coarse quality.

There is another respect in which the degree of maturation affects the quality of barley. The function (called diastatic capacity) possessed by certain constituents of the grain of converting the starch into soluble matters, is, as maturation proceeds, diminished. This branch of physiological chemistry has been worked out by Drs. Horace Brown and G. Harris Morris, in a series of investigations which are recognised to be amongst the most original in conception and instructive both in method and result of any of their kind in recent years.<sup>3</sup> They have shown the "diastases" and allied substances to be "starvation products," that is, they are present in the proportion in which they are needed for the purposes they serve in

<sup>1</sup> Samples 1, 2, and 3 graded to equal weight per 1,000 corns, and results calculated to equal moisture content.

<sup>2</sup> The nitrogen content of the *fine flour* of these two samples was determined as follows:—Outside rank, 1.50 per cent.; two next ranks, 1.19 per cent. The different nitrogen content of the whole grain was therefore clearly not due to higher proportion of husk in the latter sample.

<sup>3</sup> "Researches on the Germination of the Gramineæ." *Journ. Chem. Soc.*, lxii. (1890), p. 459. "A contribution to the Chemistry and Physiology of Foliage Leaves." *Journ. Chem. Soc.*, lxiii. (1893), p. 604.

rendering available the carbohydrates with which they are associated. Mellow grain does not need so much "diastase" to render the starch available as does steely grain, and accordingly we find that less is present. Barley may be over-matured to the extent of containing very little "translocation diastase," the name given by Brown and Morris to the active agent in ungerminated barley; and we have found from a great number of experiments that the "diastase of secretion" (i.e. that which the same authors show to be distinctive of germinated grain) is also lower after germinating mellow grain. Now, a certain minimum of "diastatic capacity" is held to be necessary for different types of malt, and although this is ruled largely by malting processes, it is also, as we have indicated, dependent on the character of the original grain, and hence, we think, to some extent is the reason why over-matured barleys are not generally liked by pale ale brewers.

#### 5. CONDITIONS AFFECTING QUALITY: CLIMATE, SOIL, CULTURE, CHANGE OF SEED.

The process of maturation being itself so complex in character, it is not surprising that it is dependent very greatly upon conditions external to the plant. Its character will depend, first and foremost, and far more than on all other conditions combined, on climate and season. It depends secondly and greatly on the natural character of the soil, and thirdly, on its artificial condition; that is to say, on the preparation, cultural and manurial, which has been given.

A recent issue of this Journal contained a most instructive paper by Mr. E. Mawley on "Weather Influences on Farm and Garden Crops," with two graphic representations of the character of the seasons in the six best and six worst wheat years respectively at Rothamsted.<sup>1</sup> We hope at some future time to be able to give similar diagrams to represent the average character of the seasons when barley of good and of bad quality has been grown, and we may say in passing that here again is illustrated the absolutely priceless character of the collection of samples and records preserved at Rothamsted. The answers to such questions as we have just indicated can nowhere else be obtained. But seasons—it is a trite remark—are so variable in this country that it is, after all, only an interesting and hardly a practical question to discuss. In a later section, however (on the Rothamsted rotation barley),

<sup>1</sup> Journal R.A.S.K. 3rd series, vol. x. part iv. 1899, p. 720.

some small attempt has been made to connect the character of the produce with the changes of season, information with regard to which has been for the most part supplied to us by that indefatigable observer, Mr. T. H. Baker of Mere Down (now of Salisbury).

As to weather conditions generally, good barley growers for the most part are of opinion that one essential for quality is that the plant shall grow without any check. Against this it may be said that autumn-sown Chevallier barley, which clearly does not experience this condition, often produces excellent quality, even when, as frequently happens, the plant has suffered so severely as to give a very poor yield. Too dry a seeding time of course means an unequal start. The influence of weather at later stages varies so greatly with different soils, that even if about the same weather conditions prevailed, as never happens, in different parts of the country, it is pretty certain that some districts would be better in one season and others in the next.

The natural character of the soil determines whether, on an average of years, barley is a profitable crop to grow. There are many soils and even districts which rarely grow good malting barley. It cannot be doubted that this again is mainly a matter of maturation. As good a plant of barley as of wheat, sometimes too good, can be got on a strong soil, but with the best of weather the maturation will be wrong and the quality coarse three years out of four. There will be too much vegetation, and seed formation will be too prolonged. A very poor, hungry soil, on the other hand, may give good quality with an extra favourable season; such as will conduce to growth without a check, just enough rain to enable the plant to make the best of what there is in the soil, and not too much drought to shorten the period of grain formation unduly, and so give premature ripening. But in the long run the best barley land is that of medium natural strength; light medium, perhaps, rather than heavy medium. Most soils on the Chalk are good because they are usually a light medium, and a marl is not so good because it is more generally a heavy medium soil.

One other point may be briefly touched on here, namely, the effect of "change of seed," that is of seeding a given variety in a different soil or climate from that in which it was grown. There are endless differences of opinion on this point, and it is difficult to form a judgment in the absence of any very definite evidence.

A general principle would appear to be that, so far as robustness of vegetation is concerned, when the soil and climatic

conditions are better than those in which the seed was reared an improvement may be expected. So that it would seem to be desirable, where this is the result desired, to transport seed from a cold to a warmer climate, and from poor soils to better ones, rather than the reverse.

On the other hand, grain which has for many generations been grown under quick ripening conditions retains its "early" habit when first transplanted, but for how long is doubtful. Speaking generally, the effect of "change of seed" will be seen much more in the vegetative than in the seed-forming period, and except in so far as the character of the grain varies with the vigour of the plant (which will generally be to a far less extent than it varies with the soil and with the weather at the time of grain formation), merely seeding with "imported" as against home-grown grain, otherwise similar in character, will have comparatively little effect on the quality of the crop. That luxuriance of growth in the plant will vary greatly with the origin of the seed is well illustrated by fig. 11, opposite. In April 1899 we planted samples of barley grown in widely different climates and soils, in adjacent rows of a small plot. Fig. 11 shows the growth made by the different plants at the end of eight weeks. No. 1, *Hordeum hexastichum*, the seed of which was grown the previous year at the Model Farm, Glasnevin, Dublin, and kindly sent us by Professor Carroll, failed to mature at all during the summer, showing that it is constitutionally a winter barley. Nos. 2, 6, 8, 9, 10 are all *Hordeum vulgare*, indistinguishable in the ear from common English winter barley, but they all ripened fairly early and within a week of each other. Notwithstanding the difference in the appearance of the seed and also in the luxuriance of growth in the earlier stages of vegetation, the resulting ears and grains of barley from two such different sources as Nos. 5 and 9 (brewing Californian and Danubian) were so much alike as to be both hardly distinguishable from *H. vulgare* of English growth. *H. vulgare* in fact will acquire the habit of either a winter or summer grain, and "Bere" (*H. vulgare*) spring grown in cold climates ripens earlier than two-rowed barley.

## 6. THE ROTHAMSTED ROTATION PLOTS.

We may derive from a careful study of the systematic treatment of different plots at Rothamsted much confirmation of what has been written above respecting conditions favouring maturation, and indeed, many of these conclusions have been

reached through a close examination of the records and samples to which Sir John Lawes and Sir J. Henry Gilbert have given us access. This is especially the case when we come to

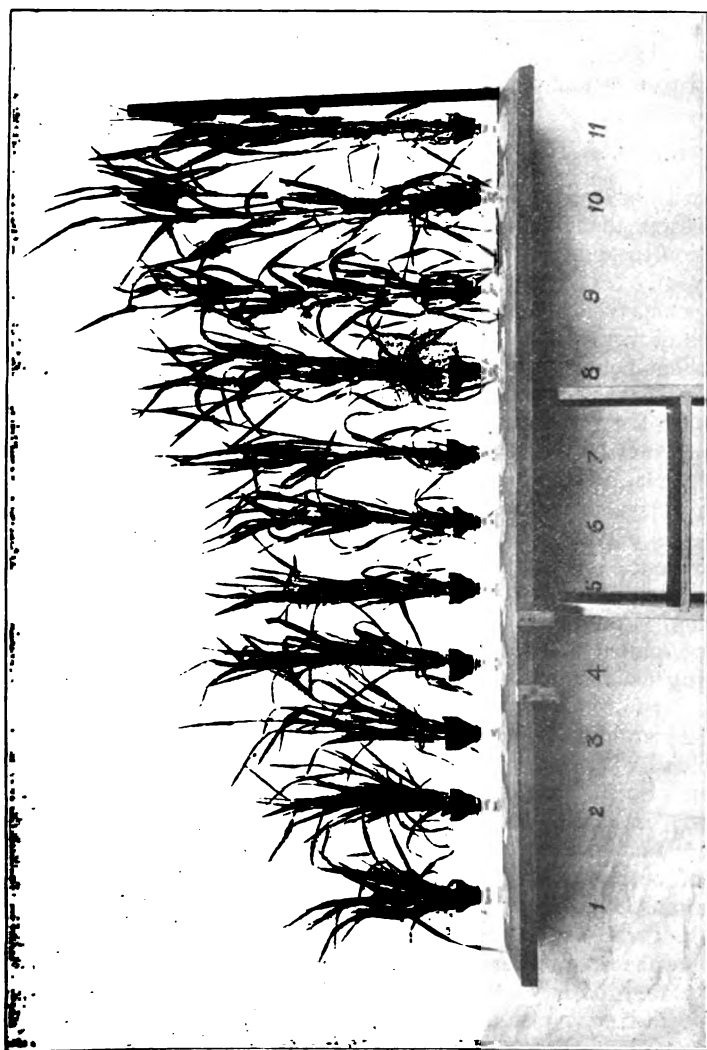


FIG. 11.—Barley plants on June 30, 1899, all Spring-sown at the same time in adjoining ranks.

1. *H. horreum*; Winter barley from Model Farm, Glasnevin, Ireland. 2. *H. vulgare*; Spanish. 3. *H. horreum* and *H. distichum* (long-grained), mixed; Syrian. 4. *H. distichum* (long-grained); Onohak. 5. *H. vulgare* and *H. distichum* (long-grained), mixed; Marnora. 6. *H. vulgare*; Danubian. 7. *H. distichum* (long-grained black and white); Onohak. 8. *H. vulgare*; Tunia. 9. *H. vulgare*; Californian brewing. 10. *H. distichum*; Smyrna. 11. *H. distichum*; English Chevallier.

consider the influence on size of grain and maturation exercised by different cultural conditions, which are at Rothamsted illustrated more completely and systematically than anywhere else.

The plots are situated in Agdell Field, and the soil is similar to that of Hoosfield, where barley has been grown year after year since 1852. It is a somewhat heavy loam with clay subsoil. The quality of the grain grown year after year at Hoosfield, and manured every year with farmyard manure and various artificials, was dealt with at length in the article already referred to (see foot-note, p. 210).

*(a) Summary of Manurial effects on continuously grown Barley.*

It will be well to recapitulate briefly the more important points then demonstrated: (1) There was a manifest deterioration in quality where phosphates had been withheld for many years. (2) Addition of potash, soda, and magnesia salts seems to have little effect on quality at Rothamsted; where, however, ammonia salts were applied with superphosphate but without potash, there was after many years a deterioration in quality. This is not seen, or only very slightly, where nitrate of soda and superphosphate are used without potash, and the difference may be due to the fact, demonstrated by Sir J. Henry Gilbert, that in the absence of added potash the barley plant takes up more soda from the soil, which would be supplied by the nitrate of soda and not by the ammonia salts. There is some evidence that prolonged use of heavy dressings of salts of the alkalies have an adverse effect on quality. It may be noted here that Prof. Maercker, whose investigations we have already quoted, found excellent results to follow potash manuring for barley in Germany. He mentions incidentally that barley is in that country frequently alternated with sugar beet. This plant takes up much potash, which is all removed, and not, as with our root crops, for the most part returned to the soil. So that under these conditions potash manuring is obviously indicated as desirable. (3) The farmyard manure plot (14 tons per acre every year) whilst giving very heavy yields of both straw and grain, gives grain of coarse quality. (4) Ammonia salts or nitrate of soda used alone give poor results, both as to quality and quantity. (5) Ammonia salts, with superphosphate, gave good results for many years, but, as before stated, both yield and quality have recently fallen off; where potash was also added the yield and quality have both been very good throughout. (6) Nitrate of soda gives good results when superphosphate is added, and the further addition of potash did not improve the crop perceptibly. In addition to the farmyard and artificially manured plots there is at Hoosfield a set of plots manured with rape cake, with and without added

minerals. The quality of the grain is at present generally equal to, or better than, that of any other plots, and distinctly better than that grown with farmyard manure. The nitrogen supplied by the 1000 lb. rape cake annually applied is about 50 lb. against about 200 lb. in the 14 tons farmyard manure, which latter, however, is less rich in phosphates.

Now, although the quality of the grain on these "continuous" plots shows at present considerable differences due to the manures, and although these are fairly constant year after year as between the different plots, the extent of the divergence is in some years slight, and, speaking generally, is far less than between the grain grown on the same plots in different seasons. That is to say, notwithstanding the extreme exhaustion of some plots and the great accumulation in others, the weather has far more to do with the size and maturation of the grain than the cumulative effects of fifty years of manurial treatment. If this is the case with barley grown continuously, that is, grown under wholly different conditions from those of ordinary practice, still more should we expect it to be the case with barley grown in rotation and conforming in this respect to the conditions of cultivation usually employed. And this we find to be the case on examining the samples of the rotation plots. The differences due to season are far greater than those due to variations in the rotation, and the divergences in quality are less than with the continuous barley plots.

### *(b) Arrangement of Rotation Plots.*

Barleys of Chevallier type are grown, and the Norfolk rotation is adopted, viz., roots, barley, clover (or beans), wheat. The roots preceding the barley are carted on one set of plots and fed,<sup>1</sup> or cut up and spread, on another, and there is a complete duplicate set of plots where the land is fallowed after barley instead of going into clover or beans. We have therefore four variations in the rotation <sup>2</sup>:—

- F.Cl. Roots **FED**, Barley, **CLOVER** (or Beans), Wheat.
- C.Cl. Roots **CARTED**, Barley, **CLOVER** (or Beans), Wheat.
- F.Fa. Roots **FED**, Barley, **FALLOW**, Wheat.
- O.Fa. Roots **CARTED**, Barley, **FALLOW**, Wheat.

There is not merely one but three series of rotation plots, each of which has since 1848 consistently received *different*

<sup>1</sup> As manurial effects are involved added food is inadmissible, and owing to this and the condition of the land it has frequently been found necessary to cut up and spread the roots, instead of feeding them. This qualification is to be understood wherever "fed" roots are referred to.

<sup>2</sup> F. denotes Fed; Cl., Clover; O., Carted; Fa., Fallow.

*manurial treatment.* The first series of four plots has been unmanured since the commencement (1848) of the experiment; the second series has had mineral manures only, superphosphate for the first eight rotations—that is from 1849 to 1881 inclusive—and superphosphate with potash and other salts since; the third series has had the same minerals with a rather heavy dressing of nitrogenous manure, viz., 200 lb. ammonia salts, and 2,000 lb. rape cake. The manures are all applied to the root crop preceding the barley, and the other crops are unmanured. Thirteen full rotations have been now completed, the thirteenth barley crop having been taken in 1897, and the present year commences the fourteenth rotation with roots. There have been, therefore, thirteen crops of barley on twelve different plots, or 156 in all. Samples of the whole of them are carefully preserved, and we have been favoured by Sir John Lawes and Sir Henry Gilbert with the opportunity of examining them at Rothamsted and have been supplied with portions of each. We have no hesitation in saying that we believe that these 156 samples constitute the most interesting and instructive set of barley samples in existence anywhere, and it is a matter of regret to us that we have not been able to do more work upon them. We hope in the future to extract further useful information from them.

After a preliminary examination, we have excluded altogether the samples of the first barley year, 1849. This leaves twelve samples for each of the twelve plots—144 in all.

We have further reduced these to one-fourth—viz. thirty-six, by making in the case of each plot three *average* samples, representing the earlier, middle, and later four rotations respectively. We have thus three samples for each of the twelve plots, the first representing the years 1853, 1857, 1861, 1865; the second 1869, 1873, 1877, 1881; and the third 1885, 1889, 1893, 1897.

It will be desirable to give briefly the characteristics of the different years, with a few notes on the appearances of the samples, and to deal with the general deductions derivable from the treatment of the plots at the same time that the average samples representing these groups of years are referred to.

The samples grown on the different plots in the first barley year of the experiment, 1849 (and not included in the average samples), are all very uniform in appearance. The colour is remarkably good considering the age of the grain. The samples have been so well preserved that no one would suppose from their appearance that they were more than a few years old.

*Agdell Field, Rothamsted, Rotation Plots.*

**SERIES 1.—No manure since 1847.**

1. Roots <b>FED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (1 F.Cl.)	1. Roots <b>FED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (1 F.Fa.)
1. Roots <b>CARTED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (1 C.Cl.)	1. Roots <b>CARTED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (1 C.Fa.)

**SERIES 2.—Mineral manures only (superphosphates only 1848 to 1880, superphosphates and potash and other salts since) applied to turnip crop in each rotation.**

1. Roots <b>FED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (2 F.Cl.)	1. Roots <b>FED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (2 F.Fa.)
1. Roots <b>CARTED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (2 C.Cl.)	1. Roots <b>CARTED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (2 C.Fa.)

**SERIES 3.—Mineral manures as Series 2, and ammonia salts and rope cake (equal to 86 lb. nitrogen) applied to root crop in each rotation.**

1. Roots <b>FED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (3 F.Cl.)	1. Roots <b>FED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (3 F.Fa.)
1. Roots <b>CARTED</b> 2. Barley 3. <b>CLOVER</b> (or Beans) 4. Wheat  (3 C.Cl.)	1. Roots <b>CARTED</b> 2. Barley 3. <b>FALLOW</b> 4. Wheat  (3 C.Fa.)

TABLE I.—*Agdell Field, Rothamsted. Barley of First Four Rotations, 1853, 1857, 1861, 1865.*

1	2	3	4	5	6	7	8
Rotation	Barley years	Weight of roots, fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 total straw	Relative value per qr.	Plot
SERIES 1.— <i>Roots unmanured.</i>							
1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat	1853	cwt. 37	32	lb. 52·6	85·0	28 6	1C.Fa.
	1857	45½	43½	53·8	105·0	27 0	
	1861	1½	35½	54·8	94·0	27 6	
	1865	7½	34½	51·5	100·2	24 6	
	Average . .	23	36½	53·2	96·0	26 10	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat	1853	27½	33	52·7	88·3	28 0	1F.Fa.
	1857	34	44½	53·8	102·2	27 6	
	1861	1½	33	54·5	91·8	27 6	
	1865	9	35½	52·4	104·3	25 6	
	Average . .	18	36½	53·3	96·6	27 1	
1, Roots CARTED. 2, Barley. 3, CLOVER. 1850 (Beans, 1854, 1858, 1862). 4, Wheat	1853	26	34½	52·0	83·7	27 6	1C.Cl.
	1857	32	48½	54·5	105·3	27 0	
	1861	1	38½	54·3	87·1	27 6	
	1865	8½	39	50·6	94·1	24 0	
	Average . .	17	40½	52·8	92·5	26 6	
1, Roots FED. 2, Barley. 3, CLOVER. 1850 (Beans, 1854, 1858, 1862). 4, Wheat	1853	19½	28½	52·4	83·7	27 0	1F.Cl.
	1857	20½	40½	53·6	97·1	27 0	
	1861	1	29½	54·0	84·5	27 6	
	1865	8½	27½	52·0	102·8	24 0	
	Average . .	12	31½	53·0	92·0	26 4	
SERIES 2.— <i>Roots manured with superphosphate only.</i>							
1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat	1853	256½	32	52·8	93·4	27 6	2C.Fa.
	1857	170½	30½	54·1	111·8	28 6	
	1861	33½	32½	55·0	94·9	28 0	
	1865	52½	31½	52·2	110·1	25 6	
	Average . .	128	31½	53·5	102·5	27 4	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat	1853	273½	39½	51·7	87·6	27 0	2F.Fa.
	1857	193½	48½	54·0	105·3	29 0	
	1861	40½	40½	55·0	94·1	28 6	
	1865	79½	39	52·2	101·8	25 6	
	Average . .	147	41½	53·2	97·4	27 6	

TABLE I.—(Continued).

1	2	3	4	5	6	7	8
Rotation	Barley years	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 total straw	Relative value per qr.	Plot
<b>SERIES 2.—Roots manured with superphosphate only—(Continued).</b>							
1, Roots CARTED.		cwt.		lb.		s. d.	
2, Barley. 3, CLOVER.	1853	223½	28½	52.7	90.0	27 0	} 2 C.Cl.
VER, 1850 (Beans, 1854, 1858, 1862).	1857	136	28½	54.1	108.5	28 0	
	1861	29½	30½	54.9	88.8	28 0	
4, Wheat	1865	68	33½	52.3	110.1	27 0	
Average		114	30½	53.4	99.4	27 6	
1, Roots FED. 2, Barley. 3, CLOVER.	1853	250½	37½	52.0	83.5	26 6	} 2 F.Cl.
1850 (Beans, 1854, 1858, 1862).	1857	196	52½	54.1	106.5	28 6	
4, Wheat	1861	38½	42½	55.0	95.2	28 0	
	1865	78½	41½	51.9	98.6	24 6	
Average		141	43½	53.2	95.9	26 10	
<b>SERIES 3.—Roots manured with mixed minerals and nitrogenous manures.</b>							
1, Roots CARTED.	1853	408½	37½	53.0	86.8	26 6	} 3 C.Fa.
2, Barley. 3, FALLOW.	1857	328½	47½	54.8	112.1	28 6	
4, Wheat	1861	87½	60½	55.0	89.3	28 6	
	1865	182½	44½	52.9	100.2	25 6	
Average		251	47½	53.9	97.1	27 3	
1, Roots FED. 2, Barley. 3, FALLOW.	1853	390½	37	51.2	70.7	25 0	} 3 F.Fa.
1850 (Beans, 1854, 1858, 1862).	1857	339½	66½	54.3	103.4	28 0	
4, Wheat	1861	87	57½	55.0	80.9	28 0	
	1865	185½	46½	51.6	75.7	24 0	
Average		250	51½	53.0	82.7	26 3	
1, Roots CARTED.	1853	396½	38½	52.6	87.1	26 0	} 3 C.Cl.
2, Barley. 3, CLOVER.	1857	333½	48	54.6	112.2	28 0	
VER, 1850 (Beans, 1854, 1858, 1862).	1861	87½	60½	54.8	87.6	28 0	
4, Wheat	1865	176½	47½	53.0	98.4	25 0	
Average		248	48½	53.7	96.3	26 9	
1, Roots FED. 2, Barley. 3, CLOVER.	1853	386	35½	51.5	74.3	24 6	} 3 F.Cl.
1850 (Beans, 1854, 1858, 1862).	1857	341½	63½	54.5	103.5	27 6	
4, Wheat	1861	72	54½	55.3	81.4	27 6	
	1865	168½	43½	52.2	79.5	24 0	
Average		242	49½	53.4	84.7	25 10	

Tables I., III., and V., give the Rothamsted record of each plot for each of the rotation barley years separately. The last column (7) requires explanation, and we have hesitated considerably before inserting it, on account of possible misconstructions. The barleys of the last rotation have been valued at Rothamsted by Mr. Hewlins of St. Ives, and Mr. Few of Cambridge, and the figures given for these years are theirs. For the figures attached to the other years we are alone responsible. It seemed difficult in any other way than by pricing the samples to indicate their general quality, but it will readily be understood that it is not an easy task to "value" barleys grown in 1853, and at intervals of four years since. The samples were dried when they were originally put up, in order to preserve them, and they have been preserved in air-tight bottles, most of which had never been opened from the time they were originally sealed up. They have doubtless altered somewhat in appearance from lapse of time. However, having been kindly given every possible facility for examining them in the sample-house at Rothamsted, we found that there still were distinct differences of quality observable between the samples.

It is almost needless to say that the values are not intended to be any other than comparative, and that they have no relation to the market values in the years of growth. Moreover, we are not prepared to justify the valuation as between different years. There is a strong likeness, as would be expected, between the twelve samples of each year in respect of colour and general appearance. But as between the samples of different years, there is, of course, the widest difference in general character, differences which in ordinary practice do not confront a buyer or a seller. For instance, the barley of 1885 is all bright in colour, that of 1889 is all weathered; whether the average difference amounts to between 4s. and 5s., as we have estimated, or to more or less than this, is a matter on which opinions would probably vary greatly. Only an approximation could be attempted in respect of comparative values in different years. What was done was to fix a price for one sample in each year, and to value the others of the same year up or down from that. If the values as between the barley of the different plots are fairly comparative in each year, then the averages of these values will be comparative also, and as our purpose here is to compare plot with plot, rather than year with year, this is all that is required. We may add that the values were all assessed before any other determinations were made upon the samples.

(c) *Characteristics of different seasons: first period, 1853, 1857, 1861, 1865.*

1853.

The barley of this year is of very different character from that of 1849, much smaller, dingy, and washed. Weight per bushel very low, 51 to 53 lb. Much more difference in quality between plots than in 1849, but little difference in yield considering that on Series 3 crops of 19 to 20 tons of roots had been grown, whilst on Series 1 there were less than 2 tons. Neither effects of manuring for the roots nor of feeding and carting have much influence on yield of grain, although the feeding of heavy root crop gives much more straw. There was a very wet July unfavourable to grain formation.

1857.

A record year in respect of yield. After fed roots fully matured, the extraordinary crop of 66½ bushels was grown, the highest ever given by any plot. Quality is above the average of the four years, and better on the high-yielding plots fully manured for roots than on the others. Very high yield and fair quality for once go together. The grain is not plump or heavy, but it is very well matured, especially on the high-yielding plots. A season favouring land in good heart during the vegetative period, and also specially favourable at the time of grain formation, for notwithstanding very heavy straw there was a very high ratio of grain to straw. A table given by Sir Henry Gilbert<sup>1</sup> shows that there was a mild and rather dry spring, followed by a very hot summer and early harvest.

1861.

With all the twelve different preparations for the crop there was little difference in quality although great difference in yield. The root crop of 1860 was nearly a failure on all the plots, and the differences in yield are due to manurial residues, but the quality on every plot was evidently influenced mainly by the season. It was all large and heavy but coarse, badly matured grain.

1865.

The preceding root crop was again poor. The barley was over average yield on all plots, but harvesting conditions affected both yield and quality considerably, for all the grain was badly weathered—"over matured" in fact. It was small,

<sup>1</sup> Lawes Agricultural Trust Lectures, U. S. Dept. Agric. p. 73.

uneven, and light; altogether of lower value than that of any of the other twelve barley years. A backward spring succeeded by very hot weather and excessive rainfall, not good for grain formation, and a wet harvest spoilt the crop.

Tables I., III., and V., accompanying this paper, and giving the full records relating to the produce on each plot in each year, are too complex for comment in detail, and are inserted mainly for purposes of reference. Table II., on the opposite page, gives for each plot separately the averages, for the first four rotation barley crops, of the recorded figures relating to produce, also the averages of the relative money valuations, and in the last three columns the determinations which we have made upon the average samples of the twelve plots. These are:—

1. Weight in grammes of 1,000 corns, affording comparison in respect of size of grain.

2. Percentage of "mealy" corns, *i.e.* corns which when cut show white fractures, indicating the degree of maturation.

3. Percentage of total nitrogen,<sup>1</sup> which will be found to vary with great regularity with the "maturation" in the samples of the same years. The more fully matured the grain the lower is the relative nitrogen content in barley of the same years. Barleys of different years cannot be so compared, as will be seen by contrasting Table II. with Table IV. (p. 234) in respect of this relation.

During the four years summarised in Table II. the yield of grain on the unmanured plots is remarkably well maintained, and on the other plots is well above the average. It is also higher than that of the first year, 1849. But the quality is very inferior in three out of the four years. The samples show what is so frequently seen, that with over-average yield there is little reason to hope for over-average quality, but rather the reverse, and that seasons which show the best return for expenditure in preparation are very often not those which give the finest grain. With wheat good yield and good quality often go together; but there are two reasons why wheat and barley differ in this respect. Weight per bushel is generally a good criterion of the quality of wheat and this frequently goes along with good yield, but it is not to the same extent a criterion of the value of barley, and is not so likely to go with

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<sup>1</sup> These percentages have not been worked out to percentage of "dry matter of the grain"; but as the samples of the same year have all been dried and preserved alike this will not affect the value of the determinations for comparative purposes. The moisture content of the various samples is about 10 per cent., and does not vary appreciably, as we have satisfied ourselves from a number of moisture determinations.

TABLE II.—*Agdell Field, Rothamsted, Rotation plots. Averages of Four Barley Years, 1853, 1857, 1861, 1865.*

Manures applied to roots	Roots fed or carted	Fallow or clover after barley	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 total straw	Relative value per quarter, four years' average	Weight per 1000 ears of average sample	Mealy corns per 100 of average sample	Total nitrogen per cent. of average sample	Plot
SERIES 1. None	Carted Fed	Fallow	owt. 23	36½	lb. 53.2	96.0	26 10	46.5	61	1.41	1 O.Fa.
	Carted Fed	Fallow	18	36½	53.3	96.6	27 1	47.1	64	1.39	1 F.Fa.
	Carted Fed	Clover	17	40½	52.8	92.5	26 6	46.8	62	1.46	1 C.Cl.
	Carted Fed	Clover	12	31½	53.0	92.0	26 4	46.3	54	1.48	1 F.Cl.
Average.											1.43
SERIES 2. Super-phosphate only	Carted Fed	Fallow	128	31½	53.5	102.5	27 4	45.6	69	1.33	2 C.Fa.
	Carted Fed	Fallow	147	41½	53.2	97.4	27 6	46.4	69	1.32	2 F.Fa.
	Carted Fed	Clover	114	30½	53.4	99.4	27 6	46.4	71	1.34	2 C.Cl.
	Carted Fed	Clover	141	43½	53.2	95.9	26 10	47.2	64	1.44	2 F.Cl.
Average.											1.36
SERIES 3. Mixed minerals, ammonia salts, and rape cake	Carted Fed	Fallow	251	47½	53.9	97.1	27 3	47.2	65	1.41	3 C.Fa.
	Carted Fed	Fallow	250	51½	53.0	82.7	26 3	46.4	58	1.55	3 F.Fa.
	Carted Fed	Clover	248	43½	53.7	96.3	26 9	47.6	60	1.47	3 C.Cl.
	Carted Fed	Clover	242	49½	53.4	84.7	25 10	46.8	49	1.61	3 F.Cl.
Average.											1.51

high yield. The other obvious reason is that barley suffers more from adverse harvesting conditions, and a fortnight's bad weather is in our climate just as likely to supervene on a heavy as on a light crop, with much worse results to barley than to wheat.

The good effect of phosphates on quality, which is so plainly shown by the continuous barley plots at Rothamsted, is also apparent in the rotation crops of the four years now under consideration. The quality of the grain on the four plots of Series 2, where only superphosphate has been applied to the preceding root crop, is distinctly better than that of the corresponding plots of Series 1, where no manure was used for the roots. There has been better grain formation, as is shown in increased ratio of grain to straw, and distinctly better maturation with less nitrogenous matter in the grain. The average weight per bushel and the size of the grain are practically the same on the three series of plots, but these are not, as we believe, data from which the malting quality of grain can be safely deduced.

It is evident that the lower *quality* on the unmanured plots is due to want of phosphates and not to lack of condition from non-supply of nitrogen, for if the latter were the case we should find that where the preceding root crop was much heavier than on the "superphosphate only" plots, as it was on the plots of Series 3 with full nitrogenous and phosphatic manures, there would have been still better quality; but this is not the case, and the evidence is irresistible that the better quality of the barley on the plots where superphosphate only was applied to the roots is due directly to the supply of soluble phosphates.

In these first four courses, then, the quality of the barley evidently did not suffer from exhaustion of nitrogen on the unmanured plots, but it did suffer from over supply to the plots of Series 3. Here the residue from the heavy compound manuring where the roots were carted, and the still heavier residue where they were fed, gave a much greater yield of grain than where no nitrogenous manure was used, but the quality was distinctly inferior to that of Series 2, and little if any better than that of Series 1.

We will now consider the effect on the quality of the grain, as it appears to have been influenced by feeding and carting respectively. There is not much difference shown. Where the root crops have been heavy, as on Series 3, the "roots-carted" plots give barley of better quality than the corresponding "roots-fed" plots. The average difference

amounts to perhaps 1s. per quarter in value, and is shown in the better maturation and lower nitrogen content. It is strange at first sight to find that in this series the "roots-fed" plots three years out of the four give no higher yield than the "roots-carted" plots. But all the crops are heavy, the lowest 37 and the highest 67 bushels per acre, and it would appear that in these four seasons the nitrogen supply was superabundant for grain formation. In each of the four seasons the straw was very much heavier on the "fed" plots, and the ratio of grain to straw was lower than on the "carted" plots. Both in 1857 and in 1861 the total produce (*i.e.* grain and straw) of the "fed" plots of Series 3 was over 3 tons per acre, one of the two plots in 1861 yielding close on 2 tons of straw. On Series 2, with very fair but much lower yields (28 to 42 bushels per acre), in these four seasons there was hardly any perceptible difference in quality between the fed and carted plots. The root crops were generally 5 or 6 tons per acre lower on these plots than on those of Series 3, and there is no sign that the feeding of them supplied in any case more nitrogenous matter than the barley needed, either for quantity or quality. The differences in yield and quality of grain due to feeding as against carting roots on Series 1 (unmanured roots), where after the first course there was almost a complete failure of the root crop, will neither in these four seasons nor in the following ones require consideration. On all these plots the land is practically unmanured fallow before the barley crop, and the only point to notice is that both yield and quality are the better for this previous fallowing, if it is possible to judge by comparison with the plot in the Hoosfield, where barley is grown year after year without manure.

Lastly, in respect of these four seasons, 1853, 1857, 1861, 1865, we have to consider the effect of clover or beans as against fallow in the rotation. Clover was sown with the barley in 1849, 1853, 1857, and 1861, but the last three crops failed, so in the following years (1854, 1858, 1862) and in 1866 beans were grown instead. Almost uniformly on all three series the inclusion of the leguminous crop in the rotation lowers somewhat the quality of the barley. The value of the leguminous crop in the rotation is of course out of comparison with the slight effect on the quality of the barley, and the point is only interesting as throwing light on the question of how far quality is affected by improved "condition" of soil, due to the under-surface accumulation of nitrogen which the clover, at any rate, promotes.

TABLE III.—*Agdell Field, Rothamsted. Barley of Second Four Rotations, 1869, 1873, 1877, 1881.*

1	2	3	4	5	6	7	8
Rotation	Barley years	Weight of roots fed or carted before barley	Busbels per acre dressed grain	Weight per bushel	Total grain to 100 of total straw	Relative value per quarter	Plot
<b>SERIES 1.—Roots unmanured.</b>							
1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat	1869	nil	21½	53·3	77·0	29 0	1c.Fa.
	1873	51½	20½	54·4	88·9	30 6	
	1877	31½	23	55·0	109·2	29 0	
	1881	32½	29½	54·3	103·7	26 6	
Average		29	23½	54·5	94·7	28 9	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat	1869	nil	21	52·6	72·5	29 0	1f.Fa.
	1873	49½	21	55·2	93·4	30 0	
	1877	32½	22½	55·0	104·7	29 0	
	1881	38½	31½	53·5	110·3	26 6	
Average		30	24	54·1	95·2	28 7	
1, Roots CARTED. 2, Barley. 3, CLOVER. 1874 (Beans, 1866, 1870, 1878). 4, Wheat	1869	nil	24½	52·8	72·4	28 0	1 c cl.
	1873	34½	23½	55·2	102·4	29 6	
	1877	17½	23½	54·2	103·2	28 6	
	1881	14	26½	52·6	96·9	25 6	
Average		16	24½	53·7	93·7	27 10	
1, Roots FED. 2, Barley. 3, CLOVER. 1874 (Beans, 1866, 1870, 1878). 4, Wheat	1869	nil	25½	52·3	74·2	29 0	1 f.cl.
	1873	29½	23	54·6	90·2	29 0	
	1877	21	23½	53·8	99·3	28 0	
	1881	21	26	54·3	99·6	27 6	
Average		18	24½	53·7	90·8	28 4	
<b>SERIES 2.—Roots manured with superphosphate only.</b>							
1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat	1869	nil	25½	54·7	77·7	30 0	2c.Fa.
	1873	142½	22½	54·5	98·0	31 6	
	1877	193½	21	54·5	118·6	31 6	
	1881	224	24½	54·3	108·0	28 6	
Average		140	23½	54·5	100·6	30 4	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat	1869	nil	30½	55·3	76·5	30 6	2f.Fa.
	1873	167½	27	54·9	99·2	31 0	
	1877	208½	31½	54·9	106·9	31 0	
	1881	238½	28½	55·0	105·5	29 6	
Average		153	29½	55·0	97	30 6	

TABLE III.—(Continued).

1	2	3	4	5	6	7	8
Rotation	Barley years	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 of total straw	Relative value per quarter	Plot
SERIES 2.—Roots manured with superphosphate only—(Continued).							
1, Roots CARTED.	1869	cwt. nil	28½	55.1	82.0	30 0	2 c.cl.
2, Barley. 3, CLOVER.	1873	170½	20½	55.3	83.7	30 0	
VBR, 1874 (Beans, 1866, 1870, 1878).	1877	188½	24½	54.8	117.8	30 6	
4, Wheat	1881	199½	24½	55.3	109.8	29 0	
Average . . .		140	24½	55.1	98.3	29 10	
1, Roots FED. 2, Barley. 3, CLOVER.	1869	nil	33½	54.9	79.6	30 0	2 f.cl.
1874 (Beans, 1866, 1870, 1878).	1873	190½	29½	55.0	94.2	31 6	
4, Wheat	1877	225½	38½	55.2	108.5	30 0	
	1881	223½	28½	55.7	113.4	29 0	
Average . . .		160	32½	55.2	98.7	30 1	
SERIES 3.—Roots manured with mixed minerals and nitrogenous materials.							
1, Roots CARTED.	1869	nil	39½	56.1	76.7	29 0	3 c.Fa.
2, Barley. 3, FALLOW.	1873	332	31½	54.9	109.8	31 0	
4, Wheat	1877	309½	30½	55.4	109.6	31 0	
	1881	450½	33½	55.9	108.0	29 6	
Average . . .		273	33½	55.6	101.0	30 0	
1, Roots FED. 2, Barley. 3, FALLOW.	1869	nil	38½	55.1	69.3	29 0	3 f.Fa.
4, Wheat	1873	331½	47	55.2	95.9	31 0	
	1877	377½	44½	55.7	97.2	31 0	
	1881	447½	48	56.1	91.1	30 0	
Average . . .		289	44½	55.5	88.4	30 3	
1, Roots CARTED.	1869	nil	43	55.6	75.3	29 6	3 c.cl.
2, Barley. 3, CLOVER.	1873	339½	31½	55.2	107.4	31 6	
VBR, 1874 (Beans, 1866, 1870, 1878).	1877	356	34½	55.5	102.8	31 0	
4, Wheat	1881	439½	35½	55.9	108.2	30 0	
Average . . .		284	36½	55.5	98.4	30 6	
1, Roots FED. 2, Barley. 3, CLOVER.	1869	nil	42½	56.1	76.6	28 6	3 f.cl.
1874 (Beans, 1866, 1870, 1878).	1873	330	45½	55.8	95.9	30 0	
4, Wheat	1877	359½	49½	55.7	90.8	30 0	
	1881	446½	50½	56.6	93.8	30 6	
Average . . .		284	46½	56.1	89.3	29 9	

*Second period, 1869, 1873, 1877, 1881.*

1869.

The barley of this year is rather small, generally heavy grain, somewhat hard but of good colour and shape, slightly grey, perhaps from weather conditions before cutting, still very useful grain of over average value. The grain of Series 1, unmanured for roots, is smaller but rather mellowier than that of the others. The differences in value of the various samples are slight, and there is, as is the case in almost every season, a certain uniformity of character or family likeness about all the twelve samples. The roots of the preceding year were a complete failure, and between the plots where they are usually carted or fed respectively, there was no difference to speak of, either in yield or quality. The yield generally was about an average and the quality evidently was influenced far less by soil than by atmospheric conditions. There was a rather backward plant in the spring, followed by a summer drier than average.

1873.

Very shapely grain, generally well matured, and differences in quality, due to preparation, slight. There are this year great differences in yield between the plots following roots "fed" and "carted" respectively. The root crops had been good on the fully manured plots (16 to 17 tons) and the season favoured the effect of manuring and feeding on yield, without producing marked differences in quality. There was a fine growing July, favourable for grain formation, and maturation was fairly good.

1877.

The grain is not unlike that of 1873 in character. Again the weight of the root crop and its disposal tells on the yield of the barley, and the quality is over average with fair crops. The plots unmanured for roots, with consequent failure of that crop, show signs of exhaustion, not only in the yield but in smaller and more uneven grain. The proportion of grain to straw is very high on all the plots. It was an unfavourable season for vegetation, with a late harvest, and there were more differences than usual in quality, due to differences in preparation.

1881.

There is again considerable difference in the quality of the barleys of the different plots. Previous manuring tells this year on weight of grain and quality generally. High yield and good quality go together, and the 50-bushel crops of plots, where

over 20 tons of roots were fed the previous year, are fully 4s. a quarter better than those of the unmanured plots, distinctly better also than those of the superphosphate only plots, where the root crop was only half the weight. The best samples are shapely and well matured. The high ratio of grain to straw shows that this was a favourable season for grain formation.

The second period of sixteen years gives four barley crops, the quality of all of which is better than either of the previous four, although neither is quite equal to the first crop of all, that of 1849. The yields, however, are not so good even in the years when full manuring has given abundant root crops preceding the barley. On the continuously unmanured plots, of course, the yield has fallen away, and varies on the four different plots in these four years from 20 to 25 bushels per acre; general exhaustion has told on the quality of the grain also, which in most years is inferior by 2s. per quarter to that of Series 2 and 3. On Series 2 (superphosphate only applied to the roots) the yields, as compared with the previous period, are not more reduced than on Series 3 (full manuring for the roots), which gives good crops ( $38\frac{3}{4}$  to  $50\frac{1}{4}$  bushels per acre), though not so heavy as the exceptional ones of the previous period. The effect of the phosphates on quality continues to be clearly shown, for notwithstanding the obvious nitrogen exhaustion, the samples of Series 2 are on the average fully equal to those of Series 3. The wholly different character of the four (1869-73-77-81) seasons from that of the previous four (1853-57-61-65) is most plainly shown in the quality of the barley on the plots of Series 3, the later seasons having favoured grain formation to a much greater extent than vegetation. Putting the four plots of this series together, the ratio of grain to straw in the later years was distinctly better (94.3 of grain to 100 straw, against 90.2), and we estimate the quality of the grain to be between 3s. and 4s. a quarter better accordingly. Table IV., on the next page, shows these points in greater detail.

The plots where clover or beans are grown after the barley show the same relations, in respect of the quality of the grain, to those fallowed after barley as have been already noted. In three out of the four rotations the crop succeeding the barley was beans. Clover was sown with the barley only in 1873. It gave three cuttings in the following year, and the effect of the undoubtedly improved "condition" of the land is very manifest in much better yield in 1877; the yield is from 3 to 7 bushels more on the clovered plots of Series 2 and 3 than on the corresponding fallowed plots. The grain is larger and heavier, but the maturation is generally perceptibly lower.

TABLE IV.—*Agdell Field, Rothamsted, Rotation Plots. Averages of Four Barley Years, 1869, 1873, 1877, 1881.*

Manures applied to roots	Roots fed or carted	Fallow or clover after barley	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 total straw	Relative value per quarter, four years' average	Weight per 1000 corn of average sample	Mealy corn per 100 of average sample	Total nitrogen per cent. of average sample	Plot
SERIES 1. None	Carted Fed	Fallow	cwt. 29	23½	lb. 54.3	94.7	28 9	43.0	68	1.26	1 C.Fa.
	Carted Fed	Fallow	30	24	54.1	95.2	28 7	43.9	69	1.22	1 F.Fa.
	Carted Fed	Clover	16	24½	53.7	93.7	27 10	45.6	63	1.34	1 C.Cl.
	Carted Fed	Clover	18	24½	53.7	90.8	28 4	45.5	55	1.32	1 F.Cl.
		Average.	23½	23½	54	93.6	28 4	44.5	61	1.28	
SERIES 2. Super-phosphate only	Carted Fed	Fallow	140	23½	54.5	100.6	30 4	42.7	78	1.13	2 C.Fa.
	Carted Fed	Fallow	153	29½	55	97	30 6	43.8	76	1.19	2 F.Fa.
	Carted Fed	Clover	140	24½	55.1	98.3	29 10	44.0	67	1.24	2 C.Cl.
	Carted Fed	Clover	160	32½	55.2	98.7	30 1	45.0	64	1.27	2 F.Cl.
		Average.	148	27½	54.9	98.6	30 2	43.9	71	1.22	
SERIES 3. Mixed minerals, ammonia, salts, and rape cake	Carted Fed	Fallow	273	39½	55.6	101	30 1	44.8	76	1.26	3 C.Fa.
	Carted Fed	Fallow	289	44½	55.5	88.4	30 3	46.2	64	1.34	3 F.Fa.
	Carted Fed	Clover	284	36½	55.5	98.4	30 6	45.6	70	1.30	3 C.Cl.
	Carted Fed	Clover	284	46½	56.1	89.8	29 9	46.2	62	1.41	3 F.Cl.
		Average.	269	40½	55.7	94.3	30 2	45.7	66	1.33	

TABLE V.—*Agdell Field, Rothamsted. Barley of Third Four Rotations, 1885, 1889, 1893, 1897.*

1	2	3	4	5	6	7	8
Rotation	Barley years	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 of total straw	Relative value per quarter	Pict

SERIES 1.—*Roots unmanured.*

		cwt.		lb.		s.	d.	
1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	17 $\frac{7}{8}$	15 $\frac{1}{2}$	54.5	58.3	28	0	1 C.Fa.
	1889	15	15 $\frac{1}{2}$	52.7	87.7	25	0	
	1893	9 $\frac{1}{2}$	19 $\frac{1}{2}$	55.8	72.5	26	6	
	1897	15 $\frac{1}{2}$	11 $\frac{1}{2}$	51.4	70.5	30	6	
Average . . .		14	15 $\frac{1}{2}$	53.6	72.2	27	6	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	20 $\frac{1}{2}$	22 $\frac{1}{2}$	54.6	72.9	29	0	1 F.Fa.
	1889	23	18 $\frac{1}{2}$	52.2	90.6	25	6	
	1893	12 $\frac{1}{2}$	19	55.5	68.3	26	6	
	1897	24 $\frac{1}{2}$	13 $\frac{1}{2}$	51.3	68.0	31	0	
Average . . .		20	18	53.4	75.0	28	0	
1, Roots CARTED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	5	12 $\frac{1}{2}$	50.8	54.3	26	0	1 C.Cl.
	1889	2 $\frac{1}{2}$	11	51.0	62.2	24	0	
	1893	6 $\frac{1}{2}$	16 $\frac{1}{2}$	55.3	69.8	26	0	
	1897	7 $\frac{1}{2}$	11 $\frac{1}{2}$	51.3	54.0	29	0	
Average . . .		5	12 $\frac{1}{2}$	52.1	60.0	26	8	
1, Roots FED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	12	16	51.3	62.1	27	6	1 F.Cl.
	1889	8	12 $\frac{1}{2}$	51.4	76.9	24	6	
	1893	6 $\frac{1}{2}$	14 $\frac{1}{2}$	55.8	63.9	26	0	
	1897	11 $\frac{1}{2}$	11 $\frac{1}{2}$	51.7	70.1	29	0	
Average . . .		9	13 $\frac{1}{2}$	52.5	68.2	26	9	

SERIES 2.—*Roots manured with superphosphate and other minerals.*

1. Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	159 $\frac{1}{2}$	12 $\frac{1}{2}$	53.7	75.8	29	0	2 C.Fa.
	1889	142 $\frac{1}{2}$	15 $\frac{1}{2}$	52.6	88.9	26	0	
	1893	226 $\frac{1}{2}$	13	55.8	66.1	27	6	
	1897	161	12 $\frac{1}{2}$	52.1	73.0	31	0	
Average . . .		172	13 $\frac{1}{2}$	53.5	74.7	28	4	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	172 $\frac{1}{2}$	17 $\frac{1}{2}$	55.3	74.1	32	6	2 F.Fa.
	1889	166	19 $\frac{1}{2}$	52.5	98.1	26	0	
	1893	263 $\frac{1}{2}$	15 $\frac{1}{2}$	56.0	78.5	28	0	
	1897	177 $\frac{1}{2}$	19 $\frac{1}{2}$	52.2	77.6	32	0	
Average . . .		194	18	54.0	80.8	29	7	

TABLE V.—(Continued).

1	2	3	4	5	6	7	8
Rotation	Barley year	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 of total straw	Relative value per quarter	Plot

**SERIES 2.—Roots manured with superphosphate and other minerals—(Continued).**

1, Roots CARTED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	cwt. 173½	19½	lb. 58.9	76.1	s. d. 29 6	} 2 C.Cl.
	1889	207	21½	53.3	98.7	26 0	
	1893	202½	15½	56.0	71.4	27 0	
	1897	215½	22½	53.4	71.2	33 0	
Average . . .		200	20	54.1	78.8	28 9	
1, Roots FED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	206	32½	55.8	77.8	31 6	} 2 F.Cl.
	1889	249½	29½	53.8	101.5	26 6	
	1893	254½	19½	57.0	82.6	28 0	
	1897	240½	37½	53.9	76.0	33 6	
Average . . .		238	29½	55.1	84.5	29 10	

**SERIES 3.—Roots manured with mixed mineral and nitrogenous manures.**

1, Roots CARTED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	298½	19	55.2	73.0	32 6	} 3 C.Fa.
	1889	431½	20	52.4	91.9	26 6	
	1893	523½	18½	57.2	72.5	28 6	
	1897	345	21½	52.7	80.2	32 0	
Average . . .		399	19½	54.4	79.2	29 10	
1, Roots FED. 2, Barley. 3, FALLOW. 4, Wheat . . .	1885	296½	32½	56.8	66.4	35 0	} 3 F.Fl.
	1889	423½	23½	53.1	71.5	27 0	
	1893	500½	25½	57.1	80.2	28 0	
	1897	331½	35½	53.8	77.1	32 0	
Average . . .		388	29½	55.1	73.8	30 6	
1, Roots CARTED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	286½	34½	55.8	79.8	32 0	} 3 C.Cl.
	1889	472½	26½	53.7	86.0	27 0	
	1893	478	20½	56.8	76.8	28 0	
	1897	343½	30½	54.2	75.5	32 0	
Average . . .		394	28	55.1	79.2	29 9	
1, Roots FED. 2, Barley. 3, CLOVER (Beans, 1890). 4, Wheat . . .	1885	280½	44½	56.6	75.6	32 0	} 3 F.Cl.
	1889	417½	25½	53.4	67.9	26 0	
	1893	333½	25½	57.1	75.9	27 6	
	1897	319½	42½	53.6	71.3	32 6	
Average . . .		338	34½	55.2	72.7	29 6	

*Third period, 1885, 1889, 1893, 1897.*

1885.

If we leave out of account, as we shall now do, the quality of the grain on the plots where no manure has been applied for nearly 40 years, the grain of 1885 is of better quality than that of any previous year. One sample, especially that of the plot 3 F.Fa. (fed roots before, and fallow after, barley), is better than any other sample of the whole fifty years. The grain on all the plots is very bright in colour and generally of very good appearance, with considerable variations, however, and much better on the plots following fed roots than on those where the produce was carted off. The yield of the different plots also varies greatly, only one plot, 3 F.Cl. (fed roots before, and clover following, the barley), giving anything like a full crop, viz., 44½ bushels. This is 12 bushels more than 3 F.Fa. above referred to, but the quality on the clovered plot is a good 3s. per quarter lower. Contrary to what was generally the case in previous years, a season which has given good quality of grain has given a very low ratio of grain to straw. Not that the bulk of straw on the ground has been heavy, but that the grain has, though well formed and of over average quality, been still more deficient in quantity. All the different conditions as to preparation tell considerably, and consistently with each other. The feeding of the roots, which were about average crops (14 to 15 tons on Series 3, and 7 to 10 tons on Series 2), as against the carting of them, improves both quality and quantity of produce on both series of plots. The effect of previous clover in the rotation is still more marked, almost doubling the yield in some cases, but with lower quality, except in the case of one pair of plots, viz. 2 C.Fa. (carted roots, barley, fallow) and 2 C.Cl. (carted roots, barley, clover). The quality on the latter plot as well as the yield is slightly the better of the two. It is noteworthy that this exception to the general effect of the leguminous crop in the rotation on the quality of the barley, which appeared for the first time in the 1881 crop, is repeated in subsequent rotations. It would seem as if where superphosphate only and no nitrogen is applied as manure, and the roots are carted off the land, the effect of the nitrogen accumulation of the clover crop is ultimately beneficial to quality. In 1885 there was a cold, wet, and backward spring, unfavourable for a good plant, but a dry warm summer and early harvest.

1889.

A bad barley year. The crop is one of the worst in respect of yield, and nearly the worst in quality of the whole 50 years.

Even where over 20 tons of roots were fed off there is not more than 26½ bushels of grain. Low weight per bushel, bad colour due to very unfavourable harvest conditions, and rough, uneven appearance, are the consequences of a season which levelled down all the previous preparation to an all-round unsatisfactory result.

1893.

Except that the grain is less weathered than that of 1889, there is little to choose between the two years. The yield is even worse than in 1889, and the grain is coarser and worse matured. The "fed" root plots are slightly better than the "carted," and fallowing again gives better grain than where beans were grown in the last rotation. There was a very dry spring and a very wet July. The season is clearly responsible for a poor plant and poor grain formation, so that with little straw there is (in proportion) still less grain, and, finally, unfavourable conditions for maturation.

1897.

Another unsatisfactory barley year, but with redeeming features not present in the two previous ones. The effects of the preparation of the previous year, viz., fed and carted roots respectively, are seen in the yields, for whilst the carted root plots give generally lower yields even than in 1893, on the plot 3 F.Cl., where a fully manured and heavy crop of roots was fed, and where there was clover in the rotation (that is to say, where the conditions conformed most closely to general practice), there was harvested nearly double the crop grown in 1893, viz., 42½ bushels in 1897 against 25½ bushels in 1893, and that, moreover, of several shillings per quarter better value. The harvesting conditions, however, as will be well remembered, were very adverse, and whilst the grain was well enough matured on some of the plots, it was more or less weathered before it could be got together. It was a season when, with good preparation, there was before harvest the promise of both good yield and good quality. On the exhausted plots there was never any promise of either, as is shown by the very poor yield (lower than that of any previous season in several of them), by the very low proportion of grain to straw, and by the very thin grain; but on the plots well prepared there was every promise of high quality as well as good yield, and notwithstanding the weathering of the grain, it was on these plots of over average quality. There was a wet spring. July was a good corn month, but rain came in the middle of harvest.

TABLE VI.—*Agdell Field, Rothamsted, Rotation Plots. Averages of Four Barley Years, 1885, 1889, 1893, 1897.*

Manures applied to roots	Roots fed or carted	Fallow or clover after roots	Weight of roots fed or carted before barley	Bushels per acre dressed grain	Weight per bushel	Total grain to 100 total straw	Relative value per quarter, four years' average	Weight per 1000 ears of average sample	Mealy corns per 100 of average sample	Total nitrogen per cent. of average sample	Plot
SERIES 1. None	Carted Fed	Fallow	cwt. 14	15½	53.6	72.2	27 6	42.6	62	1.30	1 C.F.A.
	Carted Fed	Fallow	20	18	53.4	75.0	28 0	43.1	68	1.19	1 F.F.A.
	Carted Fed	Clover	5	12½	52.1	60.0	26 3	44.4	33	1.05	1 C.Cl.
	Carted Fed	Clover	9	13½	52.5	68.2	26 9	44.3	45	1.51	1 F.Cl.
SERIES 2. Mixed minerals	Average.	Average.	12	15	52.9	68.8	27 1	43.6	52	1.42	
	Carted Fed	Fallow	172	13½	53.5	74.7	28 4	39.5	72	1.21	2 C.F.A.
	Carted Fed	Fallow	194	18	54.0	80.8	29 7	42.2	72	1.26	2 F.F.A.
	Carted Fed	Clover	200	20	54.1	78.8	28 9	43.5	66	1.21	2 C.Cl.
SERIES 3. Mixed minerals, ammonia salts, and rape cake	Carted Fed	Clover	238	29½	55.1	84.5	29 10	44.7	69	1.37	2 F.Cl.
	Average.	Average.	201	20½	54.2	79.7	29 1	42.5	67	1.26	
	Carted Fed	Fallow	399	19½	54.4	79.2	29 10	42.7	69	1.27	3 C.F.A.
	Carted Fed	Fallow	388	29½	55.1	73.8	30 6	45.2	63	1.33	3 F.F.A.
	Carted Fed	Clover	394	28	55.1	79.2	29 9	46.0	51	1.34	3 C.Cl.
	Carted Fed	Clover	338	31½	55.2	72.7	29 6	47.0	49	1.40	3 F.Cl.
Average.	Average.	Average.	380	27½	54.9	76.2	30 0	45.2	58	1.33	

The last sixteen years of the period under review, with barley in the years 1885, 1889, 1893, 1897, may be expected to show more clearly than either of the two preceding periods the cumulative effect of high manuring for the root crop as against mineral manuring only, both where the roots are carted and where they are either fed, or cut up and spread on the land; and they would also be expected to show clearly the effect on "condition" of soil and character of grain due to inclusion or exclusion of a leguminous crop (clover or beans) in the rotation. They should also demonstrate the character of the grain which will be grown on starved land, that is, where no manures are applied, and where the supposed "restorative" crops alternating with the corn are necessarily either very poor or quite a failure. Although the seasons were none of them satisfactory for barley, considering yield and quality together, yet the above-mentioned points are all well illustrated.

The plots of Series 1, which at the end of the period had been unmanured for 50 years, give, it is true, more grain than would be expected, owing doubtless to the land on the plots being practically fallow one year (roots) out of four; but the quality has distinctly deteriorated, both in respect of size of grain and of maturation. Whilst in the first four rotations the quality was on an average not more than 1s. a quarter lower than that of the superphosphate plots, and about equal to that of the fully manured plots, it is now at least 3s. worse than the latter, and very distinctly inferior to the former. There is not only deterioration due to seasons, but also greater deterioration still due to soil conditions, and it is clear from comparison with Series 2 that the inferiority of quality is due to the absence of phosphates.

The yield of roots on the unmanured land is practically *nil*, but on the plot where minerals (only) are applied with the roots there is, after 50 years, still generally more than half a crop of swedes; and where these are fed and there is also another still more restorative crop, as far as nitrogen supply is concerned, viz., clover in the rotation, as on plot 2 F.Cl., the yield of barley following is in the forty-ninth year of continuous similar rotation no less than  $37\frac{1}{2}$  bushels per acre, and that of over average quality. This plot—with a rotation of (1) Roots (manured with abundant minerals,  $3\frac{1}{2}$  cwt. superphosphate only for the first nine rotations, and the same superphosphate with about 5 cwt. potash and other salts for the last four); (2) Barley; (3) Clover or Beans; (4) Wheat—represents what may be called low farming. No part of the white straw crops is returned to the land, and only the underground

residue (very valuable, however) of the clover is left, yet the last 10 years show good average, all-round results, and even compare favourably with those given by the corresponding 3 F.Cl. plot, where the rotation is precisely the same and where 200 lb. ammonia salts and 1000 lb. rape cake are added to the minerals as manure for the roots. The crops for the last 10 years on these two plots are as follows:—

Year	—	3 F.Cl.	3 F.Cl.
		Fed roots, barley, clover, wheat, minerals only for the roots	Fed roots, barley, clover, wheat, minerals, ammonia, and rape cake for the roots
1888	Turnips .	12½ tons	20½ tons
1889	Barley .	29½ bush. (26s. 6d.)	25½ bush. (26s.)
1890	Beans .	24 bush.	16½ bush.
1891	Wheat .	50½ bush.	42 bush.
1892	Turnips .	12½ tons	16½ tons
1893	Barley .	19½ bush. (28s.)	25½ bush. (27s. 6d.)
1894	Clover .	3½ tons	4½ tons
1895	Wheat .	39½ bush.	40 bush.
1896	Turnips .	12 tons	16 tons
1897	Barley .	37½ bush. (31s. 6d.)	42½ bush. (31s. 6d.)
1898	Beans .	33½ bush.	22½ bush.
1899	Wheat .	42½ bush.	41½ bush.
	Corn . . .	277 bush.	255½ bush.
	Turnips & } Clover	40½ tons	57½ tons

The net result is that the addition of nitrogenous manure worth about 12*l.* has given nearly 18 tons of additional green food (turnips and clover), but actually less corn by 21½ bushels. The loss is mainly on the beans, which here at any rate flourish best without added nitrogenous, but with plenty of mineral, food.

Another point well worth notice is that in these last four barley years the fed-roots crops have given not only, of course, better yield, but also better quality where, being fully manured, they have been a full crop. If the yield all round had been heavier, doubtless the result as to quality would have been different, as it frequently was in previous years; and if all the available indications brought forward are considered, we believe this general principle will be found to hold good: That where the season is such as to favour early rather than late vegetation, then full supply of available nitrogen, such as residues from manures applied to previous roots, and also from the sheep-dung, will, whilst increasing yield, not at all necessarily be prejudicial to good quality, which under these conditions may be expected with a moderately hot summer and

favourable harvesting conditions. These, in fact, seem to be the conditions for good grain formation, and those which will give barley of at once good size and good maturation. The first crop of all, 1849, and that of 1857, approach nearest to fulfilling the conditions.

The best sample of the 156 (3 F.Fa. of the year 1885) was grown under the abnormal and unprofitable condition of fallowing the land one year in four, with a yield of 32½ bushels. Where clover was sown with the barley that year, and either clover or beans had been grown following barley in every previous rotation (on the adjoining plot, 3 F.Cl.), with 12 bushels more grain, the sample was inferior by a good 3s. a quarter. It is no matter for wonder that really choice samples of barley are few and far between when such a diverse set of conditions is needful for their profitable production.

There is no question that a too-prolonged period of grain formation and maturation gives heavy, large-grained, but coarse barley, with a high nitrogen content and low malting quality. The lighter soils and special seasons which favour early but not too quick ripening give the best grain. Barley spring sown is a surface feeder, but how far the roots go down, how much food they draw up from below, and for how long a period, depend on the character and conditions of the soil probably more than on the weather, except with extreme seasonal conditions. This is mainly the reason why some soils most rarely produce well-matured barley. But the natural condition of a soil is greatly modified by its treatment and the character of the cropping, and more, as all recent researches abundantly prove, by clover and similar leguminous crops than by any other ordinary means.

So it is that in the Agdell field at Rothamsted the character of the grain is influenced greatly by the leguminous crop. The grain is larger and heavier, but on this particular soil too much nitrogen is made available for good maturation of barley where clover is grown. On a lighter soil, where the nitrogen was less conserved, the comparison might not, probably would not, hold good; indeed, in some districts it is no uncommon thing to meet with good samples of "ley barley," that is, barley grown after clover ley.

One order of rotation will suit one soil and another will answer best elsewhere, and not even such a course of rotations as this at Rothamsted will answer all the questions which can be raised with respect to the influence of rotations and manures, and of both combined, on the quality of barley. The *quality* of the barley was probably not a factor which was much con-

sidered when the order of rotation was originally planned. On the Rothamsted soil we have little doubt that quality would be better if barley followed wheat, but for the adoption of the much more customary Norfolk rotation there were doubtless many other considerations outweighing this particular one. Still, we shall be pardoned for thinking our investigation of some value, if only it leads to some definite conclusions as to how, in the long run, the character of the barley crop on this particular soil has been affected by the cultural conditions which have been adopted, some of which represent those common to a large number of districts.

It will be desirable to summarise the results of this examination of the Rothamsted rotation barley, with a view to demonstrating the relations between size and maturation on the one hand, and conditions of growth on the other.

*d. Effects on quality of (1) Feeding and Carting roots ;  
(2) Leguminous crop in the rotation.*

The tables hitherto referred to have all shown "averages" of periods of four rotations. The general effect of averaging the results is to diminish the differences which are shown in individual years and plots.

Still more is this the case when we average the results of the twelve barley crops grown during the whole period of forty-eight years. Table VII., on the next page, shows the average effects of feeding as against carting roots before the barley, and also the results due to leguminous crop over the whole period. On the plots of Series 1 there are practically no root crops, and in the first part of the table the averages given are those of all the four plots of this series taken as one. To show the comparative results of feeding and carting roots on the plots of Series 2 and 3 the clovered and fallowed plots are treated as one, and similarly in the lower part of the table, to show the effects of the leguminous crop, the "fed" and "carted" roots plots are treated as one plot.

The figures illustrate what has been said as to the influence on the quality of the barley of cultural conditions varying in these two respects. The higher "condition" of soil due to feeding the roots and to the inclusion of clover or beans in the rotation gives larger and heavier, but generally, though not always, less well matured and more nitrogenous, grain. As to market value, the differences when averaged are very slight, for what is lost in size of grain from lower soil condition is (where there has been abundant supply of phosphates) made

TABLE VII.—*Agdell Field, Rothamsted, Rotation Plots.*  
*Average of twelve barley crops.*

Years	Manures applied to roots	Roots: fed or carted	Fallow or clover after barley	Bush. per acre	Weight per bush. lb.	Total grain to 100 total straw	Average value	Weight of 1,000 corns grammes	Mealy corn per 100	Total Nitrogen per cent. of grain	Plot
<i>Barley averages of twelve years after carted and after fed roots.</i>											
Average of all years {	None {	Carted and Fed {	Both plots	25	53.3	85.5	27 3	44.9	57	1.40	{ 1 C.Fa. & 1 C.Cl. 1 F.Fa. & 1 F.Cl.
Average of all years {	Minerals only {	Carted Fed {	Both plots Both plots	23½ 32½	54.0 54.3	92.4 92.3	28 8 29 1	43.6 44.8	70 64	1.24 1.31	{ 2 C.Fa. & 2 C.Cl. 2 F.Fa. & 2 F.Cl.
Average of all years {	Minerals, ammonia salts, and rape cake {	Carted Fed {	Both plots Both plots	35½ 42½	54.7 54.7	91.8 81.9	29 0 28 8	45.6 46.1	65 56	1.34 1.44	{ 3 C.Fa. & 3 C.Cl. 3 F.Fa. & 3 F.Cl.
<i>Barley averages of twelve years on plots with fallow and with clover following barley.</i>											
Average of all years {	None {	Both plots Both plots	Fallow Clover	25½ 24½	53.6 53.0	88.2 82.8	27 7 27 0	44.3 45.5	65 50	1.34 1.46	{ 1 F.Fa. & 1 C.Fa. 1 F.Cl. & 1 C.Cl.
Average of all years {	Minerals only {	Both plots Both plots	Fallow Clover	25½ 30	53.9 54.3	92.1 92.6	28 11 28 9	43.8 45.1	73 65	1.24 1.31	{ 2 F.Fa. & 2 C.Fa. 2 F.Cl. & 2 C.Cl.
Average of all years {	Minerals, ammonia salts, and rape cake {	Both plots Both plots	Fallow Clover	37½ 40½	54.5 54.9	87.0 86.9	29 0 28 8	45.4 46.4	66 57	1.36 1.41	{ 3 F.Fa. & 3 C.Fa. 3 F.Cl. & 3 C.Cl.

up for by better maturation. Perhaps, judging from the determinations of mealy corns and nitrogen content, the samples from the "carted roots" and "fallow" plots are better as malting material than they look. The general impression given by this table is that the average differences in value due to the different treatment are very slight, compared with the differences in yield which are in the reverse direction. This is so, but the divergences in character, so far as they are shown, are very consistent, and it is to be remembered that in most of the earlier and some of the later years these differences were almost *nil*, so greatly did the seasonal influences outweigh all others.

TABLE VIII.—*Agdell Field, Rothamsted, Rotation Plots.*

*Barley of the same year on different plots, and of different years on the same plot.*

Years	Manures applied to roots	Roots fed or carted	Fallow or clover after barley	Bush. per acre	Wght. per bushel	Total grain to 100 total straw	Value		Wght. of 1000 corns	Mealy corns per 100	Total nitrogen per cent. of grain	Plot	
1877	Minerals only Minerals, ammonia salts, and rape cake	{	Carted	Fallow	21	lb. 54.5	118.6	s. 31	d. 6	grms. 45.1	88	1.20	2 C.Fl.
			Fed	Clover	49½	55.7	90.8	30	0	47.6	50	1.52	3 F.Cl.
1893	Minerals, ammonia salts, and rape cake	{	Fed	Clover	25½	57.1	75.9	27	6	51.8	26	1.74	3 F.Cl.
1889	Minerals, ammonia salts, and rape cake	{	Fed	Clover	25½	53.4	67.9	26	0	45.0	83	1.27	3 F.Cl.
			Carted	Fallow	15½	52.6	83.9	26	0	41.3	86	1.08	2 C.Fl.
	Minerals only												

That these differences are sometimes considerable is shown by Table VIII., which gives an impression of the variations occurring in some seasons between grain grown under different cultural conditions, and the still greater difference which seasons make where the cultural conditions are the same. In many years, as we have already said, differences of quality due to preparation were almost *nil*; but in seasons like 1877, a more or less trying season for grain crops, there were wide differences in the character of the grain, as the figures for two

plots in that year show clearly. In 1893, a disastrous season, the quality of the grain was a great contrast to that of 1877, as will be seen by comparing the results on the same plot. That year there was a hot spring, which burnt up everything, followed by over 5 inches of rain in July, but fair weather for harvesting the very light crops, which were altogether under-matured. In 1889, to take a third year, there was a fine growing spring with plenty of vegetation, but a wet July, followed by a constantly showery harvest-month and grain very much weathered.

But if the reader will refer to yet another set of figures, the conformities observable between (1) the ratio of grain to straw, (2) the size of the grain, (3) the degree of maturation, and (4) the percentage of total nitrogen, are, we think, sufficiently instructive to be pointed out in some detail, and to facilitate this there is shown in Table IX., on the opposite page, the relative order of the plots in these respects.

Considering the difficulty of ensuring absolutely average samples for the different determinations, and making some allowance for errors of experiment, there is close conformity in all three periods between the mellowness of the grain and the percentage nitrogen content, the mellow grain containing the lowest proportion of nitrogenous matter. Grain which is good in these respects is generally, but with much less close conformity, produced where the ratio of grain to straw is high, and, where straw is disproportionately heavy, grain is nearly always worse matured.

In the first period there is little difference in the size of the grain on the different plots, and size bears no definite relation to maturation; but the best three plots in respect of ratio of grain to straw are the same three which have the best matured grain with lowest nitrogen content, and the worst three plots are those in which these conditions are all reversed. In the two later periods the effects of extreme exhaustion on the plots of Series I upset the conformity in some respects, but it is still very marked as between good maturation and low nitrogen content and *vice versa*. In these two periods the smaller grain is the best matured generally. This relation between size of grain and maturation is a most important one in the case of malting barley, especially, as we have already indicated, in connection with the introduction of new varieties, and it undoubtedly requires further investigation, with a view to the demonstration, if possible, of conditions under which good size and good maturation will go together.

Finally, referring to Table X., p. 248, if we leave out the un-

TABLE IX.—*Agdell Field, Rothamsted, Rotation Plots. Relation between (1) ratio of grain to straw, (2) degree of maturation, (3) nitrogen content, (4) size of grain grown on twelve plots in three periods.*

*Averages of 1853, 1857, 1861, 1865.*

	Total grain to 100 total straw from highest to lowest	Maturation : mealy corns per 100 from highest to lowest	Nitrogen per cent. of grain from lowest to highest	Size : weight of 1000 corns from lowest to highest
1	2 C.Fa. } 102.5	2 C.Cl. } 71	2 F.Fa. } 1.32	2 C.Fa. }
2	2 C.Cl. } to	2 C.Fa. } to	2 C.Fa. } to	1 F.Cl. }
3	2 F.Fa. } 97.4	2 F.Fa. } 69	2 C.Cl. } 1.34	2 F.Fa. }
4	3 C.Fa. }	3 C.Fa. }	1 F.Fa. }	2 C.Cl. }
5	1 F.Fa. } 97.1	2 F.Cl. } 65	3 C.Fa. } 1.39	3 F.Fa. }
6	3 C.Cl. } to	1 F.Fa. } to	1 C.Fa. } to	1 C.Fa. }
7	1 C.Fa. } 92.5	1 C.Cl. } 60	2 F.Cl. } 1.47	1 C.Cl. }
8	2 F.Cl. }	1 C.Fa. }	1 C.Cl. }	3 F.Cl. }
9	1 C.Cl. }	3 C.Cl. }	3 C.Cl. }	1 F.Fa. }
10	1 F.Cl. } 92.0	3 F.Fa. } 58	1 F.Cl. } 1.48	2 F.Cl. }
11	3 F.Cl. } to	1 F.Cl. } to	3 F.Fa. } to	3 C.Fa. }
12	3 F.Fa. } 82.7	3 F.Cl. } 49	3 F.Cl. } 1.61	3 C.Cl. }

*Averages of 1869, 1873, 1877, 1881.*

1	3 C.Fa. }	2 C.Fa. } 78 to	2 C.Fa. } 1.13 to	2 C.Fa. }
2	2 C.Fa. }	2 F.Fa. } 76	2 F.Fa. } 1.19	1 C.Fa. }
3	2 F.Cl. }	3 C.Fa. }	1 F.Fa. }	2 F.Fa. }
4	3 C.Cl. } 101.0	3 C.Cl. }	2 C.Cl. }	1 F.Fa. }
5	2 C.Cl. } to	1 F.Fa. } 70	3 C.Fa. } 1.22	2 C.Cl. }
6	2 F.Fa. }	1 C.Fa. } to	1 C.Fa. } to	3 C.Fa. }
7	1 F.Fa. }	2 C.Cl. } 64	2 F.Cl. }	2 F.Cl. }
8	1 C.Fa. }	2 F.Cl. }	3 C.Cl. }	
9	1 C.Cl. } 93.7 to	3 F.Fa. }	1 F.Cl. } 1.32 to	1 F.Cl. }
10	1 F.Cl. } 90.8	3 F.Cl. }	1 C.Cl. } 1.34	1 C.Cl. }
11	3 F.Cl. } 89.3 to	1 F.Cl. } to	3 F.Fa. } 1.34 to	3 F.Fa. }
12	3 F.Fa. } 88.4	1 C.Cl. } 53	3 F.Cl. } 1.41	3 F.Cl. }

*Averages of 1885, 1889, 1893, 1897.*

1	2 F.Cl. }	2 C.Fa. }	1 F.Fa. }	2 C.Fa. }
2	2 F.Fa. }	2 F.Fa. } 72	2 C.Fa. } 1.19	2 F.Fa. }
3	3 C.Cl. }	3 C.Fa. } to	2 C.Cl. } to	1 C.Fa. }
4	3 C.Fa. }	1 F.Fa. } 66	2 F.Fa. } 1.27	3 C.Fa. }
5	2 C.Cl. }	2 C.Cl. }	3 C.Fa. }	1 F.Fa. }
6	1 F.Fa. }	3 F.Fa. }	1 C.Fa. }	2 C.Cl. }
7	2 C.Fa. }	1 C.Fa. }	3 F.Fa. } 1.30	1 F.Cl. }
8	3 F.Fa. }	2 F.Cl. } to	3 C.Cl. } to	1 C.Cl. }
9	3 F.Cl. }	3 C.Cl. } 49	2 F.Cl. } 1.40	2 F.Cl. }
10	1 C.Fa. }	3 F.Cl. }	3 F.Cl. }	3 F.Fa. }
11	1 F.Cl. } 68.2 to	1 F.Cl. } 45 to	1 F.Cl. } 1.54 to	3 C.Cl. }
12	1 C.Cl. } 60.0	1 C.Cl. } 33	1 C.Cl. } 1.65	3 F.Cl. }

manured plots where extreme exhaustion has led to results which are not conformable with those of the other plots, we shall see that, taking the grain of the whole period, the relations between grain formation, size, maturation, and percentage of nitrogenous matter are very clear, and confirm unmistakably the conclusions which we have already reached. With all these different conditions of preparation for the barley, good grain formation (ratio of grain to straw) goes along with comparatively small but kindly, well-matured corn, of high carbohydrate but low nitrogenous composition. The best quality, apart from size, is found where there has been no restorative crop for over 50 years, where everything grown has been removed, and where nothing but mineral manure has been

TABLE X.—*Agdell Field, Rothamsted, Rotation Plots. Relation between average (1) ratio of grain to straw, (2) size of grain, (3) maturation, (4) percentage of nitrogen, in the crops of the manured plots for the twelve barley years between 1853 and 1897.*

Manures applied to roots	Roots fed or carted	Fallow or clover after barley	Total grain to 100 total straw	Size of grain : weight per 1000 corns	Maturation : mealy corns per 100	Nitrogen per cent. of grain
Minerals only	Carted	Fallow	92.6	grammes 42.6	73	1.22
	Fed	Fallow	91.7	44.1	72	1.26
	Carted	Clover	92.3	44.6	68	1.26
	Fed	Clover	93.0	45.6	62	1.36
Minerals, ammonia salts, and rape cake	Carted	Fallow	92.4	44.9	68	1.31
	Fed	Fallow	81.6	45.9	62	1.41
	Carted	Clover	91.3	46.4	60	1.37
	Fed	Clover	82.2	46.6	53	1.47

applied ; needless to add the yield has been very small. The largest grain, but the worst in other respects, is that of the plot where two crops out of four have been restorative, where plentiful and complete manuring has given heavy root crops, fed off, and followed by high yields of barley.

## 7. SUMMARY.

1. The different varieties of barley may be referred to two types, viz. the wide and the narrow eared. The wide-eared barleys had, before their recent re-introduction, been almost displaced by the narrow-eared ones. We think that the wide-eared type is probably the older, but on this point there is room for difference of opinion. Barleys of this type are quite distinct in

the character of the grain, and are stouter in the straw. They will be found suitable for soils where the latter quality is absolutely necessary. It is very desirable that the two types should be kept distinct.

2. If the malting quality of the grain is to be taken into account in the introduction of new selected or crossed varieties of barley, due regard should be given to the following considerations:—The heavier the straw, the coarser and therefore the lower in value will be the grain generally. A low ratio of grain to straw usually goes along with grain with high content of nitrogenous matters and defective maturation. A large, coarse grain of high weight per bushel is not as good malting material as a smaller grain well matured. In fact (given vitality) maturation is the most important quality of barley from a malting point of view, and generally with the varieties at present cultivated the smaller grain is the better matured. If by means of selection or cross-fertilisation varieties of larger body, but maturing equally well, can be secured, a great step in advance will be made.

3. Maturation is physiologically a post-ripening process, the character of which depends largely on the pre-ripening, and this in turn on the soil conditions. Too early ripening on thin soils due to drought, and too late ripening on strong soils, both give a highly nitrogenous grain which will not mature well even under favourable natural conditions, and is always more or less steely and unworkable. Even with well-ripened grain maturation depends on sufficient time being allowed before and after cutting, but above all on weather conditions.

4. The Rothamsted results with barley grown in the Norfolk rotation extending over more than fifty years and with twelve different cultural conditions lead to the following conclusions:—

(a) The good effect of soluble phosphates on quality of grain is (as was also shown with continuously grown barley) most marked. The plots manured with minerals only have given the best yield of grain in proportion to straw, showing the unmistakable effect of phosphates in assisting grain formation. This series of plots also shows a lower percentage in the grain of nitrogenous matters than either of the other series. The barley, though often comparatively small, is well matured—better in this all-important respect than where no phosphates are applied, and also better than where, with heavy nitrogenous dressings in addition to minerals for the preceding roots, the land is in better condition and gives much higher yields.

(b) As between roots carted and roots fed as preparation for barley, the effect of the higher manuring on the quality of the succeeding barley is not at Rothamsted, taking the average of the years, very great either way, although of course there is much heavier yield than where the roots have been carted. The maturation of the grain is frequently, though by no means always, better after carted roots, but the difference in this respect is counterbalanced by an almost uniformly larger grain on the "fed" plots, counterbalanced that is, as far as what, to the best of our judgment, would be the relative market value of the grain; but we think, in view of our determinations of degree of maturation and content of nitrogenous matters, that the "after roots carted" barleys are better than they look in relation to those after roots fed (or cut up and spread). In any case it has to be remembered that no added food of any sort has ever been fed on the plots, and that therefore the generally accepted opinion that roots fed, with oil-cake added, is too good a preparation for barley, as far as quality is concerned, is not controverted by these results.

(c) The general effect of high "condition" of soil on the quality of barley is shown at Rothamsted in the comparison afforded between clover as against a year's fallow in the rotation. The average results under every condition of preparation for the root-crop show that this leguminous crop leaves a residue which increases the yield, but gives less well-matured grain. Apart, however, from the value of the included clover crop, the increased yield of grain more than compensates for the somewhat lower maturation. It is a remarkable fact, that the effect of this crop is, in recent years, more apparent upon the barley three years after than it is upon either the wheat or roots which intervene. It points to the fact that barley is of all the farm crops the one which is most affected by "condition" of soil, and this is true, not only of the total amount of produce, but also of the character of the grain.

These relations of cultural conditions to quality are fully illustrated by Tables VII., VIII., IX., and X.

It is an unfortunate deduction from all the research which has been given to this matter by others, as well as ourselves, that the soil conditions which increase yield are frequently not those which improve quality. It is even more clear that all the various conditions combined have far less influence on quantity and quality of produce than the season has. Weather conditions are fortunately unlike soil conditions in this respect, that those which favour grain formation and good yield are also favourable to good quality.

The fact that barley does not want, for quality, too high condition of soil, points to "after wheat" as the best preparation for the crop. This plan is not, of course, adopted solely or even mainly in view of better probable quality of barley. It suits the arrangements of the farm in many other respects in some districts. As regards the barley, what is lost from lower "condition" of soil as against "after roots fed" is frequently made up for, in respect of yield, by the better tillage possible, and in quality by the better maturation which is due to earlier seeding and ripening. Early seeding is not always possible after roots, and the more "kindly" if smaller grain which is generally produced in districts (like that with which we are most familiar) where the "after wheat" practice is the custom is, we think, the combined result of generally more favourable conditions for the ultimate maturation of the grain.

We have to acknowledge the help of Mr. M. J. Cole, of 16 Lawn Crescent, Kew, in preparing sections for micro-photography, and to thank Mr. W. Dyson (late of Goldthorpe, Notts) and Mr. J. B. Chevallier for giving us information as to the origin of varieties with which their names are associated. Our special thanks are due to Mr. G. T. Hill, of the Department of Coins and Medals of the British Museum, for casts of coins and many references as to pre-historic barleys; to Drs. Schinz, Augst, Messikommer, and Schröter of Zurich for drawings, specimens, and various information regarding the barley of the Lake dwellings; to Dr. Sidney Williamson for notes on the maturation of wheat; to Mr. T. H. Baker, author of "Records of Seasons," for notes on weather conditions in different years; to many other agricultural friends for the benefit of their experiences in barley-growing; to Prof. Carroll, of Glasnevin, Dublin, and Dr. Maercker, of Halle, for samples of newly introduced varieties; and to Sir John Lawes and Sir Henry Gilbert, to whom we owe most of all, for the unstinted facilities they have given us for the investigation of the results of their life-long labours at Rothamsted, so far as they bear on the subject of this paper.

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## THE AGRICULTURAL SYNDICATES OF FRANCE.

ANYONE gifted with an eye for things agricultural, and visiting a rural district of France, cannot fail to be struck with the evidence of a remarkable change which has come over the face of French agriculture within the past fifteen years or so. There seems new life infused into the calling, in which two decades ago all still appeared despondency and decline. People have become active and hopeful once more. We hear very much more, indeed, than we did about the "claims of agriculture," but very much less about the dismal "agricultural crisis." And everybody appears agreed that the happy change is attributable to the creation of "agricultural syndicates," which have for the first time in French history, and to all appearance merely by a side-wind, under cover of a law never designed for the purpose, brought about the object which for generations past French Governments have had warmly at heart and have found themselves unable to attain—that is, the application of the principle of combination to the furtherance of common interests in agriculture.

Count Rocquigny, in his last little book upon this subject,<sup>1</sup> of which he has become the specialist of specialists, makes, I think, a little too much of that strange freak in legislation which constituted the "professional syndicates" law of 1884 the starting-point for an agricultural revival, the possibilities of which are, in M. Ernest Brelay's words, "illimitable." That law, which was intended as a Trade Union law, restoring to persons of any particular calling the constitutional right, taken from them in 1834, to combine, and into which the word "agriculture" was inserted—nobody quite seemed to understand why (and that is why nobody objected)—actually in the last stage of its passage through the Chambers, has indeed been taken advantage of to give a legal status to agricultural syndicates. And this circumstance ought to serve to emphasise the

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<sup>1</sup> Comte de Rocquigny, *Les Syndicats Agricoles et leur œuvre*. Armand Colin et Cie., Paris. 4 francs.

fact that French "agricultural syndicates" are not purely the "co-operative societies" that we should be tempted to take them for, but "professional syndicates" formed to vindicate and further the interests of a particular calling by all means available, not excluding an influence to be exercised, wherever opportunity may permit, upon legislation. The law of 1884, which, if viewed as a co-operative law, still presents itself as extremely faulty (more particularly inasmuch as it does not allow co-operative dealing, but only negotiation as by a broker), was made use of simply because there was no other to invoke. For the law dealing with co-operative societies is defective in other respects, and wherever people are not bold enough to take the risk of stretching doubtful points on their own responsibility, the ideal organisation at the present time appears to be that of an agricultural syndicate and a co-operative society created side by side, supplementing one another as occasion may require.

However, at the time when M. Waldeck Rousseau brought in his Trade Union measure, the first agricultural syndicate was already actually formed, at Blois. The departmental officer of the Ministry of Agriculture stationed in that city, Professor Tanviray, had in fact discovered the great want of the hour. Co-operation, which had, even in its application specifically to agriculture, at that time already scored some signal triumphs in this country and, to a much greater extent, in Germany, was, as Dr. Havenstein has put it, "in the air." In France agricultural requisites such as artificial fertilisers, seeds, feeding stuffs, implements, and the like, were scarcely used, indeed barely known, because they were offered at almost prohibitive prices, and of very questionable quality. To open to agriculture these treasures revealed by science, so M. Tanviray perceived, they must be offered at fair prices and of good quality, and such effect was to be accomplished only by co-operation. His original aim, therefore, was, so his colleagues at Blois have assured me,—he himself had at the time of my visit already been removed to Amiens,—wholly limited to co-operative supply. But he very soon discovered that, if fertilisers, modern implements, good seed, &c., were to be employed by French cultivators, those cultivators must first be made to understand the use and value of these articles; in this respect, indeed, M. Tanviray found them still terribly backward. Thus, at an early stage, technical agricultural education was very properly grafted upon the syndicate programme, as a second object. And, although in some respects on educational ground the French syndicates have been decidedly outstripped by their

own offspring in Italy—who have invented that very useful institution, the *cattedra ambulante*—it is probably to their educational services, as much as to anything else, to lectures and discussions, syndicate laboratories established at all points and analysing syndicate purchases, and, not least, to that voluminous and very instructive agricultural press which the syndicates have called into being, that the signal results achieved are due.

Once agricultural reformers had come to the second of these two points, they soon discovered that the same instrument of common action might be applied with advantage to a number of further objects. Indeed, objects appeared to multiply under their hands. There was work to be done in common, sometimes ordinary field and meadow work, dykework and draining, sometimes special work, such as watching and fumigating vineyards, to keep off the frost in cold nights. Moreover, there were wide stretches of devastated vineyards to be replanted, with American sets, to be eventually improved by French grafts. There were costly implements to be purchased for common use, such as threshing machines; accordingly, threshing syndicates were formed. There were certain plants that might be cultivated in common, such as flowers on the Riviera, "immortelles," and capers. Produce might be manufactured in common; and, although French vinegrowers and beetroot cultivators have not yet shown enterprise enough to follow the examples set them with such encouraging success by their neighbours in Germany—who have their co-operative wine-presses, a veritable boon to the public, on the Rhine, the Ahr, and the Moselle, and their co-operative "central factories" for making beetroot sugar—they have managed to turn the same principle to good account in a smaller way, by manufacturing their fruit pulp in common, preparing their capers for the market, pressing their olives for oil, &c., to say nothing of those co-operative dairies which are, of course, a long-established institution in France. Orchard-growers and cider-makers found that they might with advantage co-operate for rearing better fruit, wheat-growers for the improvement of their seed and for giving their corn a higher market value. Horse-breeders in the north, cattle-breeders in the Limousin and the Nivernais, combined with similar objects in view, and they are now reaping the same good results. Then there was co-operative insurance, which Count Rocquigny has done as much as anyone to develop and extend—insurance of every description, but more particularly live-stock insurance, and insurance against hail. And under the new workmen's compensa-

tion law syndicates are already beginning to insure co-operatively against the fresh burden thereby imposed. There was agricultural credit, that cherished ideal of French agriculturists and governments for more than a generation back. The example of Germany and Italy showed that co-operation might provide that. And, greatest desideratum of all, there was a prospect of a more remunerative sale for agricultural produce.

We had best not look too much for results outside the limits of this purely economic programme. By dint of a clever electioneering manoeuvre one rather influential agricultural syndicate, which addresses itself specifically to questions of legislation, scored a remarkable legislative triumph in 1889, pinning down the majority of the new Chamber to its own agricultural programme. And it is something now for it to be able to lead a serried army of about 800,000 agriculturists against the progressive income tax and the graduated death duties which democratic legislators propose to introduce in France, and with the same sturdy bodyguard to make a determined stand in support of Protection. But the success of 1889 is not likely to be repeated in the defence of capitalist interests; and protectionism threatens in the end to estrange the agricultural syndicates from some of their best present friends and allies, the co-operating working classes, and thereby to weaken them for other purposes.

Let us, however, see what the syndicates have accomplished in France on purely economic ground. In doing this we ought to bear in mind that the syndicates are as yet really only an army of outposts. Some districts of France, indeed, swarm with them; but others scarcely know them. Their number is estimated to have reached about 2,500, and their membership about 800,000, which is only about a tenth, perhaps less, of the total number of landowners. There remains, therefore, plenty still for the syndicates to do; and there remains, moreover, a great deal in their practice to be rendered more perfect. However, they have accomplished not a little. To begin with, as their main spokesmen particularly boast, they have "democratised" the use of artificial manures, feeding-stuffs, and the like. At the same time they have "moralised" the market of these articles by insisting on full weight and good quality. They have brought about a reduction in the prices of these commodities by as much as 20, 30, 40, and even 50 per cent. And yet the dealers do not grumble, because they find that the large increase effected in the volume of their business makes up for the loss of not quite legitimate profit. France now feeds better, manures better, tills better, and accordingly produces

more and at a proportionately reduced cost. Those saddening deserts produced by the phylloxera have been replanted. The breeds of every variety of stock, down to pigs, but more especially of horses, in Normandy and the Boulonnais, have been materially improved. Sires have been stationed in convenient localities for the use of members, to the manifest improvement of breeds, and the Boulonnais syndicate has even brought out its own stud-book. The produce of orchards and cider and perry presses and also of corn-fields, and, of course, of creameries and what have come to be called "cheeseries," has likewise benefited in quality and economy of production, as competitors in this country know to their cost.

Agricultural credit has not yet been brought up to nearly the level at which Frenchmen desire to see it. In truth it still contrasts rather disappointingly with what has been accomplished on similar ground in Germany; though, to give Frenchmen their due, efforts and sacrifices on their part have not been wanting. The reason evidently is, that, like some other people addressing themselves to the same problem, they have persisted in regarding as the crucial point of the task to be accomplished the provision of ample money, to be contributed by the State or by wealthy patrons, rather than the creation of a new and adequate security which, once obtained, may be relied upon to command credit. However, the lessons of past failures are evidently not being lost upon the leaders of the movement, so there is reason to hope that by degrees the co-operative credit practised by syndicates will be reshaped on better lines.

Greatest interest will probably be thought in this country to attach to the experiments made by agricultural syndicates in respect of common sale. At some points those experiments have proved decidedly successful. The northern horse-breeders, and a considerable number of cattle-breeders, now sell their animals to better advantage through their syndicates, acting as agents for them. Growers of early vegetables, potatoes, onions, strawberries, asparagus, and the like have also managed to establish a good footing in the wholesale markets, English as well as French. Their syndicates have succeeded in convincing French railway companies that they will not find themselves losers by conceding reduced tariffs in consideration of increased quantities. And large consignments of the articles mentioned are now being regularly moved at the proper seasons to the great centres of consumption, to the distinct gain of French growers. Large quantities of grapes are likewise conveyed at vintage time, for blending purposes, from the south and Lorraine to districts in which the native wine commands a

better name, syndicate dealing in this matter directly with syndicate. A large trade is also done in the co-operative sale of wine, cider, perry, and even Armagnac and Cognac, on the part of syndicates, whose annual exhibitions of their produce at Paris show how widely the practice of co-operation has already spread.

With respect to other agricultural produce experiences vary. The chairman of a large central syndicate, with about 10,000 members, formed specifically for the purpose of organising business relations all over France, has informed me that the great difficulty to be contended with is this, that farmers will not always deliver up to sample. The same syndicate has, however, discovered means of making itself extremely useful to French farmers. Representing an influential trading body, it has been successful in persuading railway companies to lower their charges for carriage. It has rendered the sale of beasts from the provinces at the Paris cattle market very much easier, cheaper, and more remunerative. The vendor now simply consigns his beast to be sold to the capital. Under an arrangement with the syndicate, the company has it looked after on the journey. In Paris the salesman of the syndicate takes charge of it, and, knowing the market very much better than any provincial farmer, generally disposes of it at a better price. This syndicate does a large trade now in seeds and grain, fertilisers, implements, and other articles. In some instances public authorities, more particularly those of the army, have come to the aid of local and provincial syndicates, placing with them contracts for provender and the like. This is much appreciated, but it is a troublesome proceeding, much encumbered with red tape.

There is, thus far, not much success to record in the establishment of co-operative butcheries intended for the sellers' benefit. And the French co-operative bakeries, which have become extremely numerous, and which are only now being supplemented by co-operative corn-mills, are really consumers' societies. In some parts of France, for instance in the south-east, where there is a particularly active and well-administered group of syndicates, the expedient has been employed, not as yet with very striking success, of selling in the co-operative stores other purchased produce by the side of that contributed by the farmers' syndicate. Count Rocquigny expresses disapproval of such dabbling in non-agricultural co-operative supply—I suspect, with a view to reassuring suspicious traders. In Switzerland, however, in the union of agricultural societies which has its headquarters at Winterthur, the combination of ordinary supply with agri-

cultural has distinctly proved a serviceable practice, thanks to which the business and influence of those societies are daily extending. There can be no question that the problem of organising sale in common presents peculiar difficulties, and it cannot be pretended that French agricultural syndicates have finally overcome all these. However, they have mastered a good many, and certainly brought the problem very much nearer to a solution.

The distribution of agricultural syndicates in various parts of France is very unequal. There are departments, like the Isère, the Doubs, and the Indre-et-Loire, which teem with them, having about 100 to a department. There are others which possess scarcely any. The mere number is, of course, no clue to activity and success attained, since there are large syndicates, having up to 14,000 members, and small, with only 20 or 25, active syndicates and idle, well-managed and mismanaged.

It must also by no means be understood that the organisation of agricultural syndicates is in every instance perfect, and everywhere the same. The law, to do it justice, places no obstacle in the way of formation or organisation. It suffices that a man should be a Frenchman and in full possession of his citizen's rights to make him eligible for membership. And the rules may be drawn practically as members please. No fee is chargeable for registration. It is sufficient that the rules should be deposited by authorised persons at the *mairie* of the place where the syndicate has its headquarters.

These rules vary very much among themselves. The number of objects named is, generally speaking, surprisingly large. The syndicates take power to do all sorts of things, even though their intention be to confine themselves to co-operative purchase only. But it is one thing to make admission easy, and quite another to induce a sufficient number of French peasantry to join, many of whom are backward beyond anything that we can conceive, and all of whom are wanting in personal initiative, and expect to be pushed to whatever they are to do by some superior person. In ordinary life it is the prefect or the priest who pushes them. Hence a considerable number of agricultural syndicates labour under the defect of what Count Rocquigny rightly condemns as the system of "patronage."

It was, of course, in the first instance, mainly the rich men of the locality on whom the duty devolved of giving a start to the movement, men who aimed, more or less altruistically, at benefiting the large mass of petty cultivators, their neighbours, most of whom were found to be very deficient

in business capacity. Thus it was Count de la Bouillerie who formed the threshing syndicate in Anjou, Count Lejéas who organised the credit syndicate in Genlis, the late M. Bouvet who created the well-known large syndicate of Poligny, providing, in each case, money, and giving without stint their own or else their dependents' time and labour. The small cultivators and *métayers* had to be slowly trained to the work. There are syndicates, as a rule the smallest, but by no means the least active, which glory in being veritable "little republics," in which every member pays the same subscription and exercises the same rights. But in very many cases the invidious distinction is still upheld of *membres fondateurs*, who subscribe largely and govern, and *membres effectifs*, who subscribe little, in some cases very little indeed, and benefit by the syndicate, but are denied all voice in the government. Indeed, I have met with one in which tenants (all being small folk) became entitled to membership in the local syndicate *ipso facto* by their tenancy, thanks to a subscription made collectively on their behalf by the landlord. It is by this means—that is to say, large subscriptions from large folk, small from small—that in many cases the funds required are raised. Since the syndicate must not deal in goods, large funds are not really necessarily required at the outset.

Some syndicates have been fortunate, or unfortunate, enough to obtain a grant from the Government. Others, a smaller number, have fared still better in obtaining a donation or a legacy, large or small, from some private benefactor. Beyond this, syndicates build up a little property of their own by charging a brokerage, often to vendor as well as to purchaser, on the goods of which they negotiate the sale. By this means reserve funds have been already accumulated amounting to 1,000*l.*, 2,000*l.*, and in one case 4,000*l.*, which place the societies in rather a strong position. Members are, as a rule, recruited in the first instance at public meetings, in which the objects of the syndicate and the advantages to be secured by joining it are explained. That applies more particularly to syndicates for a certain local district. Syndicates having for their object the furtherance of some peculiar industry or branch of agriculture, such as breeding, cider-making, &c., are frequently formed by the interposition of agricultural societies dealing with such branch or industry. Syndicates extending over the whole of France, like the *Syndicat Central* and the *Syndicat Agricole Economique*, are formed with the help of correspondence, the press, and such large gatherings as the annual meeting of the *Société des Agriculteurs de France*, which has between 11,000 and

12,000 members. The administrative organisation is as a rule very simple. From among the persons qualified, what we should call a general committee is elected. This is named *chambre syndicale*. The *chambre syndicale* elect from their midst a smaller *bureau*, or executive committee, upon whom really the lion's share of the work falls. It depends upon the activity and the ability of the *bureau*, whether the syndicate does good work or only indifferent. The general body of members, or so many of them as choose to come, meet only once or twice a year. The election of members as a rule takes place either by the *bureau* or the *chambre syndicale*. There is very much that is loose and elastic in syndicate practice that may be expected to shape itself more perfectly under the teaching of experience. There are plenty of blemishes, no doubt, but, take them altogether, it cannot be questioned that the agricultural syndicates have really done most valuable work, and conferred substantial benefits upon their country. It may not be amiss to inquire what causes have enabled them to accomplish this.

In the first place it will have to be allowed that, in spite of the lamentable backwardness of the French rural population, local circumstances in France peculiarly favour their action. M. Georges Leygues puts the present number of proprietors of land at no less than 14,074,801, whereof 10,426,368 are said to own under five acres each. In any case property is exceedingly subdivided; it is mainly in the hands of freeholders, and the remedy of combination is bound to have something of the effect of first cultivation on virgin soil.

Next, agricultural syndicates in France have been signally fortunate in finding most capable and active men, devoted to the cause and ready to give up their time freely, where virtue must be its own reward, in all parts of the country. It conveys no meaning to English readers to speak of Duport, Fontgalland, Larnage, Riboud, Guinant, Deusy, Laage de Meux, and so on. But this able officering unquestionably stands for not a little in the success attained.

Beyond this, widely as individual opinion may differ among those engaged in the movement as to particular methods, as regards the main object to be kept in view, they were, from the very outset, perfectly at one among themselves, and perfectly clear in their views. And they have held to that common object with commendable tenacity. Their movement was to be a *farmers' movement*, benefiting *agriculture*. Once united, they might be friendly with other forms of co-operation, and more particularly they might study to cultivate good relations with supply societies which—if, unfortunately, they were not, for the

most part, so lamentably weak, and catering for people of such very humble wants—might really have fulfilled their hopes in helping them to dispose of their produce. But it never occurred to anyone in France that industrial working men co-operators and philanthropic Christian socialists would be the proper teachers of agricultural co-operation, which requires special technical knowledge. The two forms of co-operation, that is, farmers' and industrial working men's, are identical, of course, in their main principle, but of necessity widely different in character and in their objects.

Again, and not least, the organisers of French agricultural syndicates very wisely, like Mr. Plunkett and his friends in Ireland—whom Count Rocquigny rather too ambitiously claims as their imitators—built up their fabric from the bottom to the top, creating the local syndicate first, and making it self-sufficient, instead of building down from the top to the bottom, as the late Lord Winchilsea tried to do. It was by this means that they gave strength and stability to the structure. Every brick must be perfect in itself before it could be put into the wall, which was to keep it in its place, not give it its first strength. In their further combination they have likewise shown remarkable judgment and discernment. They appear to have centralised and decentralised just to the proper extent. There are some local syndicates absolutely isolated and detached, but the majority are systematically united among themselves. And there are local unions of all descriptions, adapted to circumstances, cantonal, departmental, regional, and national; and, on the other hand, unions determined by peculiar common interests, such as the pursuit of viticulture, horse- and cattle-breeding, cider-making, &c.

We find precisely the same thing in Denmark, a country in which agricultural organisation has been carried even to greater perfection, and in which, as the Royal Danish Commissioner tells us in a very interesting report recently presented to the International Co-operative Alliance, a man may be a member at the same time of no less than eight or ten different syndicates or societies—for the sale or purchase of his butter, eggs, honey, pigs, manures and so on, or the serving of his cow, his mare, &c.—besides educational bodies. There is no feature in the organisation of French agricultural syndicates more deserving of notice than this, and the point deserves to be pushed still further home. Undoubtedly agricultural co-operation is very much stronger in Germany than it is in France, and has accordingly achieved more signal triumphs, if measured by volume or money value. But in it we

still see clearly exemplified—less, it is true, now than a little while ago—the separatist tendency inherent in German character, which in our own early days saddled us with the Heptarchy. There are ever so many different “systems,” and among themselves the followers of such “systems” have shown themselves very Jews and Samaritans, declining to have dealings the one with the other. The gross abuses practised by dealers’ “rings” have at length recently led them to combine, at any rate for common purchase. And there are signs of a growing inclination to draw more closely together in a general way. The French syndicates have never been subject to similar divisions. They freely agree to differ among themselves on points of detail, but they act together in the main, and from such union there has resulted real strength.

Once more, and lastly, French agricultural syndicates have served their purpose as well as they have done because they have succeeded in linking together in one and the same union *all* classes interested in agriculture—not landowners only, or tenants, or *métayers*, or labourers. Actually every class is represented in their ranks, the great landowners, at present by about 4,000 (among 800,000), the labourers by as many as about 600 in one single syndicate. It is true, the labourers claim their place in the syndicates not really *as* labourers, but as very diminutive cultivators, but they are labourers all the same, and represent the labouring interest. The consequence of all this combination is, that the syndicates are in a position to speak to France as the representatives of *all agriculture*, not of one or other agricultural interest only, and accordingly with very much greater weight.

These, I believe, are generally admitted to be the features in their organisation to which French agricultural syndicates are beholden for their triumph. For further particulars concerning the movement I must refer to Count Rocquigny’s admirable little book, which tells its tale with a conciseness and lucidity worthy of all praise, and with great fulness of detail, and which, as the record of a remarkable success, will certainly repay perusal to anyone interested in the welfare and development of agriculture.

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## FUMIGATION FOR INSECT PESTS.

### INTRODUCTION.

THERE is abundance of evidence indicating that fumigation for the destruction of insect pests is destined to play an important part in fruit farming, in horticulture generally, and in forestry. At present the practice is only just emerging from the rudimentary stages in which it has been common for generations. Until quite recently the burning of sulphur, tobacco, or some preparation of nicotine has been the only method of fumigation adopted by horticulturists in this country, or, so far as I can learn, in any other part of Europe, even in greenhouses, and any extension now in progress is still in the earliest experimental stage. In the United States, on the other hand, systematic experiments in fumigation have been carried on for a number of years with important results, so that an account of modern progress in the practice must begin with a statement of what has been done in that country.

### FUMIGATION IN THE UNITED STATES.

The most important development of this method of destroying insects dates from September 1886, when Mr. D. W. Coquillett, a special agent of the American Department of Agriculture, deputed to make observations and experiments upon the Cottony Cushion scale (*Icerya purchasi*), which was causing a great amount of damage to fruit-growers in California, discovered the efficacy of hydrocyanic acid gas (prussic acid) for the destruction of this and other scale insects.

Like other experimenters, Mr. Coquillett first tried a multitude of washes, none of which proved effectual. Next he tried fumigation with the vapour of bisulphide of carbon, with partial success. In his report for 1897 Mr. Coquillett states that fumigation with this gas for the destruction of scale insects on orange and other fruit-trees had been tried for several years by Mr. J. W. Wolfskill and Mr. Alexander Craw, of Los Angeles, tents being placed over the trees for the purpose. The gas killed the insects and eggs with which it came in contact, but proved an intractable agent for the regular

fumigation of trees, because of the long time required for the evaporation of the liquid, and the sinking movement of the vapour. A few other gases had been tried by these experimenters, and many at an earlier date by Dr. George Dimmock, one of the editors of "*Psyche*," chiefly on beetles. Up to the time of Mr. Coquillett's arrival in California, however, no means of destroying scale insects by fumigation or otherwise to an extent that could be considered successful had been devised.

#### SUCCESS WITH HYDROCYANIC ACID GAS.

Mr. Coquillett tried several gases, but found only one thoroughly effectual. This, as already intimated, was hydrocyanic acid gas, generated by the mixture of potassium cyanide, sulphuric acid, and water. For some time he had great difficulty in so regulating the volume and condition of the gas as to prevent the destruction of the foliage of trees as well as insects. After months of experimenting, however, he made the treatment sufficiently successful to induce the Board of Supervisors of Los Angeles County to withdraw the offer of a reward of a thousand dollars for a perfect exterminator of the Cottony Cushion scale, which they had made in November 1885.

Mr. Coquillett's first appointment under the Department of Agriculture expired before he had made his very important discovery; but he continued to experiment on his own account, and it was when working independently that he first tried hydrocyanic acid gas. His success was only referred to in a few lines as probable in the late Professor Riley's report for 1896, and the Report of the Department of Agriculture for 1887 is the first in which details of experiments are given.

In 1888 Mr. Coquillett tried fumigation with arseniuretted hydrogen gas for the destruction of scale insects, but found it less satisfactory than hydrocyanic acid gas.

In 1889 and 1890 the use of the gas was improved and simplified, and, in his report for the latter year, Professor Riley referred to the continued work of Mr. Coquillett in California, and stated that arrangements had been so perfected that a fruit-grower could fumigate from thirty to forty trees in a night with one tent. Most large orchardists, he added, used six tents at once, and in one case four men with that number of tents fumigated 240 trees in one night. The reference to night treatment indicates the discovery of the fact that the foliage of trees is much more likely to be injured by the gas when the sun shines than it is at night or on a cloudy day. In reference to this point Professor Riley observed that in the daytime the

light decomposed the gas, and converted it into other gases injurious to trees, but less fatal to insects than hydrocyanic acid gas; also that trees were less liable to injury when more or less in a state of rest than when their functions were in full activity. In this report the now notorious San José scale is first noticed as having been the subject of experiments, but only by means of various washes.

In his report for 1891 Professor Riley stated that the process of treating trees with hydrocyanic acid gas was being extensively used in Southern California, not only in the orange groves, but also in the nursery, where imported trees were subjected to fumigation to rid them of insect pests.

For trees over 12 feet in height a derrick was said to be necessary for putting up the tent and removing it. The tent was allowed to remain over a tree for a period varying from fifteen to thirty minutes, according to the size of the tree; but the curious notion that the size of the tree should regulate the time required to kill the insects upon it was found, of course, to be a mistaken one.

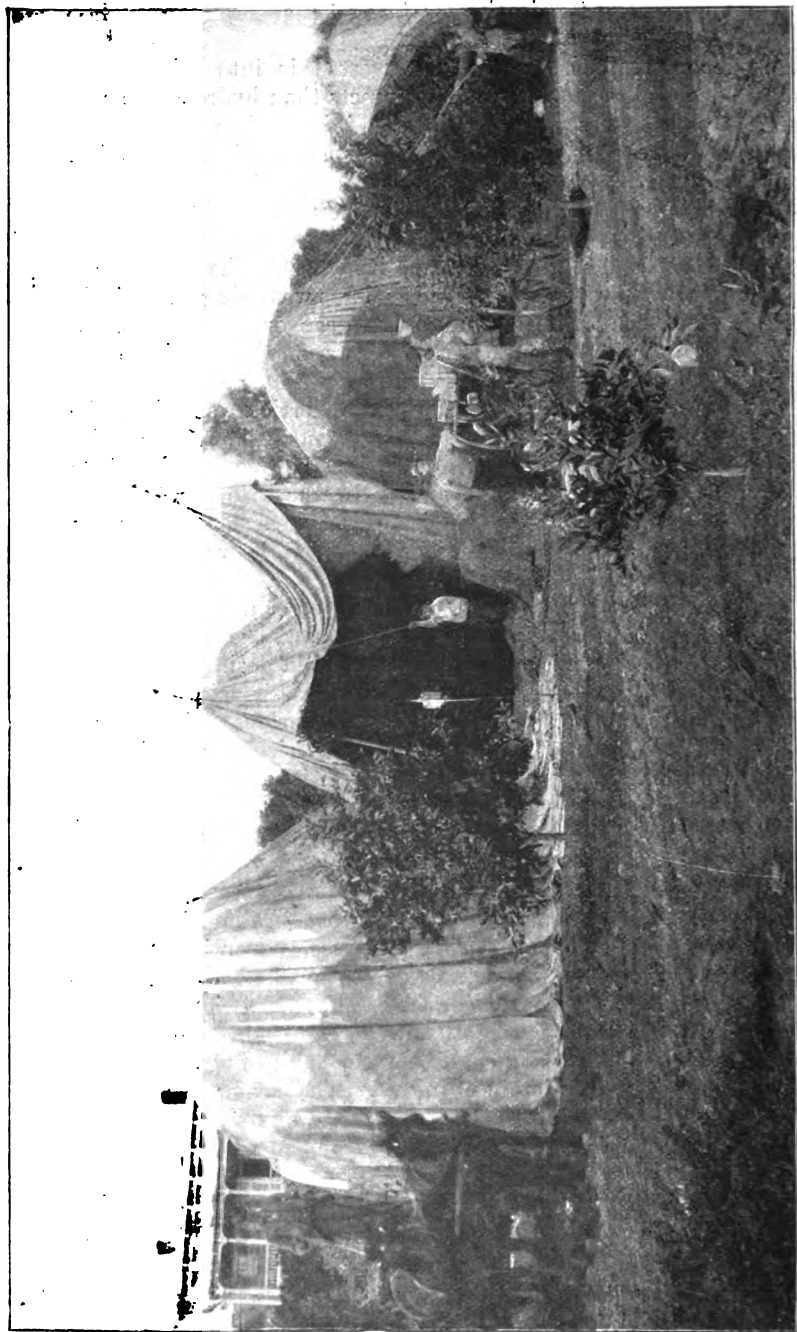
The proportions of cyanide, acid, and water used at the time in question were not the same as they are now, because unrefined cyanide was used then, and later it was found desirable to have the refined and stronger quality. A table is given in the report, showing the quantities used for trees of various heights; but the proper method is to allow certain quantities per cubic foot of space in the tent. Moreover, some varieties of trees and plants will withstand a much greater strength of gas than others.

According to the Report of the Department for 1886, the practice of fumigating with hydrocyanic acid gas at the time differed but little from that of earlier years. It was followed to a great extent for citrous<sup>1</sup> trees in Southern California, but not widely elsewhere. For deciduous trees, excepting nursery stock, it had not been found practicable to adopt the plan extensively, apparently because of the breakage of twigs caused by throwing tents rapidly over them. Orange and lemon trees, with their abundant foliage and compact habit of growth, could be treated with a minimum of injury. The proportions of the materials for generating the gas used in 1896 for orange trees were equal quantities of cyanide and sulphuric acid, and double the quantity of water.

The usual method of applying the gas treatment for growing trees in 1896 is illustrated on page 266, from an electrotype,

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<sup>1</sup> The word "citrous" is used throughout this article as an adjective denoting the orange, lemon, and allied fruits.



**FUMIGATION IN TENTS.**

(From Mr. Marlatt's Report, Division of Entomology, Year Book of the U.S. Department of Agriculture, 1896.)

kindly supplied by the Department of Agriculture through the agency of Mr. L. O. Howard, Entomologist to the Department. The picture originally appeared in an article on "Insect Control in California," by Mr. C. L. Marlatt, First Assistant Entomologist, in the Year-Book for 1896.

In Southern California, Mr. Marlatt said, the work was usually done by contract under the direct supervision of county horticultural commissioners, who furnished tents and material at a nominal charge, with one experienced man to superintend the work, and a crew of four men to operate the tents. The wages of the men were paid by the owner of the trees. The tents were of two forms, sheet tents of octagonal shape for large trees and bell tents for trees under 12 feet in height. Two men could easily throw a bell tent over a small tree, and thirty-six to forty tents could be handled by four men. They were rapidly thrown over the trees, Mr. Marlatt added, the director following closely, and introducing the chemicals; so that, by the time the last tent had been adjusted, the first one could be removed to an adjoining tree. In this way an experienced gang of four men and one director could treat 350 to 400 small trees in a night of eleven or twelve hours, the expense, under such conditions, averaging only about 4*d.* a tree.

For large trees the sheet tents were used, uprights and pulleys being employed, as shown in the centre of the illustration. About fifty trees averaging 30 feet in height could be treated in a night, at a cost of about 3*s.* 2*d.* per tree. It was not considered feasible to fumigate trees over 30 feet in height.

The canvas of the tents was sometimes rendered sufficiently impervious to the gas by painting it lightly with boiled linseed oil; but, besides stiffening it and adding to its weight, the use of oil was open to the further objection that it led to the canvas burning by spontaneous combustion, unless it was carefully watched until the oil had dried. A much better material for the purpose, Mr. Marlatt said, was obtained by soaking in water the chopped leaves of the prickly pear cactus—growing wild in Southern California—for twenty-four hours, and using the liquor.

Mr. Marlatt added that, although the gas treatment was probably the most thorough of all methods of destroying scale insects, complete extermination was very rare, and therefore it had to be repeated every two or three years. In another part of his article he describes some experiments with steam as having given good results, but less complete than those of hydrocyanic acid gas, and under more difficult conditions of

operation. He thought, however, that something practicable with steam as an agent might be accomplished in the future.

After 1896 the Year-Books of the Department of Agriculture ceased to contain the divisional reports published in them up to that date, and such further information as has been given in reference to the gas treatment of insects has appeared in separate bulletins, excepting brief references included in the miscellaneous receipts for the preparation and use of insecticides given in the Year-Books. In the volumes for 1897 and 1898 it is stated that the proportions of the chemicals for generating hydrocyanic acid gas are from  $\frac{3}{4}$  oz. to 1 oz. avoirdupois of refined potassium cyanide (98 per cent. pure), slightly more than 1 fluid ounce of commercial sulphuric acid, and 3 fluid ounces of water, to every 150 cubic feet of space enclosed. These proportions are given in reference to growing fruit trees and nursery stock. The operator is directed to place a glazed earthenware pot holding one gallon or double that quantity on the ground within the tent, putting the water in it first, next the acid, and lastly the cyanide in large lumps (to delay the rapidity of the generation of gas), and leaving the tents closed for forty minutes. The operation, it is added, should be carried out only at night or on a cloudy day.

It is curious that nothing is said in these directions or in Mr. Marlatt's article as to the precautions adopted by the operators against the inhalation of the extremely poisonous gas. Probably the man who drops the cyanide into the acid and water performs the operation while one portion of the tent is held open by himself or an assistant, instantly drawing back, and dropping the canvas immediately. It is usual to have the dose of cyanide in a paper bag, dropping the bag in with its contents.

In a "Farmers' Bulletin" on "Important Insecticides," written by Mr. Marlatt, and issued by the Department of Agriculture in 1898, a summary of his article, already noticed, corrected up to date, is included, with illustrations. In referring to the proportions of the materials for generating hydrocyanic acid gas, as given above, the writer states that a much greater strength can be employed for nursery trees when found necessary. The explanation is that nursery trees are fumigated when in a dormant condition. Mr. L. O. Howard informs me that for dormant nursery stock the quantities of cyanide, acid, and water referred to as used for growing trees are applied in every 100 cubic feet of space, instead of 150 feet.

Further information kindly given by Mr. Howard is to the effect that hydrocyanic acid gas is now used very generally in the treatment of nursery stock in the United States after the trees

have been dug up, and previous to removal for transplanting. Fumigation is done in small houses built for the purpose, or in rooms which can be tightly closed. For established trees, he adds, it has been employed to a considerable extent in Maryland, and to a less extent in other Eastern States, as well as generally for citrous trees in California. But, in Mr. Howard's opinion, for large deciduous trees fumigation under tents is not satisfactory; and, as a rule, insect pests on such trees can be more efficaciously dealt with by spraying.

It is to be observed that orange and lemon trees often require to be treated when in fruit, and washes at such a time would injure the fruit, whereas the gas does no harm to it. This explains why the gas treatment has become common in the orange groves of California, and to a less extent in Florida.

The latest publications of the Department on fumigation with hydrocyanic acid gas relate to its application in green-houses, which will be noticed subsequently.

#### FUMIGATION IN MARYLAND.

Since the pioneer work of Mr. Coquillett was completed, no one has done as much experimenting with hydrocyanic acid gas as Professor W. G. Johnson, Entomologist at the Maryland Experiment Station; and, it may be added, no one else has done so much to improve the method of fumigation. His researches, moreover, are of special interest to English fruit-growers, as they have been directed mainly towards the treatment of such fruit trees and bushes as are commonly grown in this country. Professor Johnson has been most obliging in answering inquiries as to his work, methods, and the apparatus used by him in fumigating nursery stock and growing fruit trees.

The necessity of fumigating fruit trees was first realised in the Eastern States in August 1893, when the San José scale was found to have gained a footing there; and the first application of hydrocyanic acid gas east of California was made by Mr. Coquillett in a Virginian orchard in March 1894. Very little was done, Professor Johnson says, towards perfecting the system of application or determining the physiological effect of the gas upon deciduous trees during the next two years. From what he had seen of the application of the gas to orange trees in California, Professor Johnson felt certain that it could be applied, with proper precautions, to deciduous trees in the East. Accordingly, in the spring of 1897, he began a series of experiments, on behalf of the Maryland Station, upon young

pear, apple, plum, and nectarine trees, badly infested with scale, as they came from nurseries or from orchards of one year's growth. The trees were treated in a fumigatorium constructed specially for the purpose, and afterwards were planted out. Not a single living scale could be found after the operation, or a year later, when they had made good growth.

These results were so entirely satisfactory that Professor Johnson began an extensive set of experiments upon bearing trees in orchards in the following autumn. He set himself to determine (1) the physiological effect of the gas upon the trees; (2) its effect upon the San José scale; and (3) the practical utility of fumigation in the Eastern and Southern States in all descriptions of weather and at all hours of the day and night. The results of the several experiments are given in a Bulletin published for the Maryland Experiment Station in 1898.

In some cases the foliage of the trees was badly singed, and careful observations had to be made in reference to the strength of the gas and the conditions under which it was used in order to avoid this evil. But, as the functions of the foliage had been discharged for the season, less care was necessary than would have been desirable in the spring or summer. It was found that the greatest injury was done to the foliage while the sun was shining, but that the dormant leaf and fruit-buds were not injured even when the foliage had been turned quite brown and caused to fall quickly; also that trees treated in the morning before or directly after sunrise, or immediately before or just after sunset, had their foliage very little affected; that those treated at night suffered no injury at all, even when double the usual amount of gas was applied; and that the scale insects were entirely destroyed when the weather was calm and dry, whether sunny or cloudy. Windy or wet weather, no doubt, interfered with the efficiency of the operation. The conclusion arrived at was that no better means of destroying the scale insect than fumigation with hydrocyanic acid gas could be hoped for.

This conclusion does not necessarily differ from that of Mr. Howard, to the effect that large deciduous trees can be more efficaciously dealt with by spraying than by fumigation, as none of the trees in the experiments of 1897 were described as over 10 feet in height.

It is obvious, however, that the gas is equally effective upon insects, whatever the sizes of the trees which they infest may be, and that the only difference arises from the difficulty of covering very large trees. It may be said that there is also much difficulty in effectually spraying trees of great size, while

it is doubtful whether all the insects of any kind were ever killed on a tree of any size by spraying, as they have been repeatedly by fumigation.

After testing various quantities of gas, Professor Johnson fixed upon 0.20 gram of cyanide of potassium, 98 per cent. pure, per cubic foot, for the outdoor fumigation of deciduous fruit trees when in a dormant state. The cyanide should be used in small lumps. For every ounce by weight of cyanide  $1\frac{1}{2}$  fluid ounce of sulphuric acid and  $2\frac{1}{4}$  oz. of water are required. The water is first placed in glazed earthenware pots, the acid being next added, and the cyanide in paper bags dropped in last, after which the tent is immediately closed.

A tree is left exposed to the gas for at least half an hour, and for forty-five minutes to an hour when time and other conditions permit; but these figures, like those relating to the quantity of gas, refer only to trees in a dormant stage, or when the foliage has discharged its functions for the season.

In his first trials Professor Johnson used tents; but he soon became dissatisfied with them, because it is difficult to estimate the cubic contents of a tent, while some damage is occasionally done to the twigs of trees in throwing tents over them or in uncovering them. Accordingly he constructed a set of large box-shaped coverings, made of light wooden framework covered with 8-oz. ducking, oiled. These coverings are 6 feet square at the base and 8 feet high, with a hood extension of 7 feet, so that, allowing 2 feet for the bending of the twigs, trees 17 feet high can be fumigated under them. The cubic contents of the box portion can be easily worked out, and the measurement of the hood is known when either wholly or half extended. Therefore any fruit-grower can estimate the total cubic contents with sufficient accuracy.

Each box tent is so constructed that the sides can be screwed together first, and the hood is then screwed on to the top with slats. When the hood is not in use, it falls inside the box. The apparatus is taken from a tree by means of a mast and gaff, such as one used on sailing boats, being lifted by means of a windlass and pulley. The entire tent weighs only 135 lb., and costs in Maryland between 4*l.* and 5*l.*, or no more than an ordinary large tent, while the mast and rigging cost about 2*l.* 10*s.* With care they will last for many years. The rigging is placed on the running gear of a farm cart, and drawn through an orchard by hand. Professor Johnson says that 170 to 200 trees, 15 feet to 17 feet high, can be fumigated under the box tents by three men in a day.

In March 1898 further experiments were carried out on

young plum trees, the standard quantity of gas (0.20 gram of cyanide per cubic foot of space enclosed) being used. Although the buds were just unfolding no injury was done to them. Early in June plum trees infested with lice were fumigated with gas, 0.16 gram per cubic foot being used. The exposure was for only five to twelve and a half minutes, and, although the sun was shining, the foliage, fully expanded, was not injured, while all the lice were killed. Still later, on July 8, some cherry trees were treated with the same volume of gas for five to ten minutes. The trees were infested with cherry slugs, and only about 60 per cent. of them were killed by an exposure of five minutes, while longer exposure severely injured the foliage, and destroyed all the slugs. This experiment, therefore, was not successful. There is a great deal yet to be done in order to determine the rules under which fumigation with hydrocyanic acid gas can be safely applied to various kinds of trees and shrubs in different stages of vegetation.

#### THE FUMIGATION OF NURSERY STOCK.

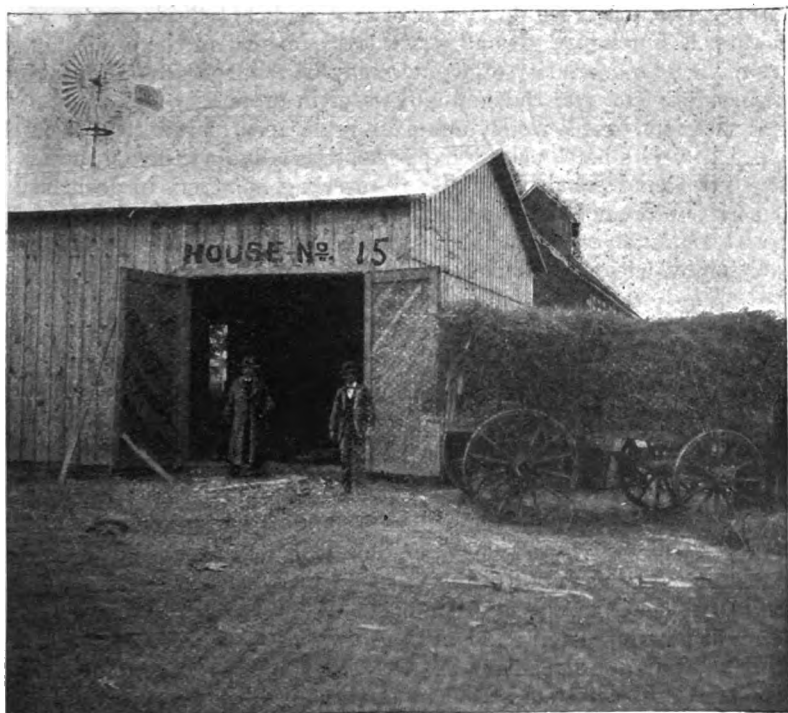
Some of the early experiments in the fumigation of nursery stock with hydrocyanic acid gas have been mentioned incidentally already, details being left for separate treatment, as this is the most important branch of fumigation so far as hardy fruit trees and bushes are concerned.

As shown on a preceding page, Professor Johnson began his fumigating experiments with nursery stock. They were carried out, however, only on a small scale in the first instance, and circumstances rendered it highly desirable later on to begin some much more extensive and varied trials.

Some of the American States, among which Maryland was first, were induced by the San José scale scare, and the success of the gas treatment, to pass a law rendering the fumigation of nursery stock compulsory. It became, therefore, of the utmost importance to ascertain the effect of various densities of gas upon different kinds of nursery trees and bushes. Accordingly, after some intermediate experiments, in the spring of 1899 Professor Johnson commenced an extensive series of experiments, beginning with young apple trees.

On a small scale nursery stock may be fumigated in boxes without tops, 8 or 10 feet long, and 3 to 4 feet wide and deep, rendered gas-proof. The young trees are packed in the box and held in place by cleats, after which the box is turned upside down, loose earth being got ready beforehand and trodden round the edges, after the materials for generating

the gas have been introduced. For larger nurseries much larger structures are needed, and there were in Maryland at the beginning of the present year thirty-seven fumigating houses, through which five to six million trees can be passed annually. Some houses will hold 12,000 to 15,000 trees, according to size, and others 1,000 to 10,000 each. One nurseryman has a fumigating house divided into two compartments, each of which will hold a waggon loaded with trees, as shown in the accompanying illus-



A LARGE FUMIGATORIUM.

tration. The houses should be closely boarded, and lined inside with thick building paper. They should have flues in the roof for ventilation after fumigation has been completed, and two doors opposite to each other for speedy airing. It is convenient to have a small room at one end of a fumigating house, in which chemicals and pots can be stored; and if there be also a second small chamber, lined with paper, it can be used for fumigating small lots of trees.

The quantity of potassium cyanide used as a rule for fumigating nursery stock in dormant condition is 0.25 gram per cubic foot of space, with 50 per cent. more sulphuric acid than cyanide, and 50 per cent. more water than acid. For example, in the large room shown in the illustration on the preceding page, there are 564 cubic feet, and this multiplied by 0.25 indicates 141 grams of cyanide. To reduce this to ounces, the quantity is divided by 28.35, making a small fraction less than 5 oz., which is the quantity needed for the room. Then there would be  $7\frac{1}{2}$  fluid ounces of acid and  $11\frac{1}{4}$  fluid ounces of water. For treating small peach trees, budded in the preceding summer, the quantity of cyanide may be reduced to 0.18 gram per cubic foot, and the acid and water in proportion. This also is sufficient to kill woolly aphis on apple trees, or black aphis on peaches, with half an hour's exposure. Usually forty-five minutes will be found sufficient to kill any insects; but trees in dormant condition are not harmed if left much longer exposed to the gas, and commonly the last batch treated is left in the closed house all night, without suffering any injury.

The results of an extensive series of experiments in showing the maximum resisting power of each of various kinds and grades of nursery stock will be issued in a bulletin by the Maryland Experiment Station. In some cases the normal quantity of cyanide was increased threefold, without injuring apple trees; and a trial of six times the usual quantity per cubic foot of space injured only one variety, probably through some accidental circumstance, as it is quite as hardy as any of the other varieties. Thus, while it is difficult to kill insects on growing trees in the spring or summer without injuring the foliage, there is hardly any risk of harming hardy fruit trees when they are in dormant condition, as they are when removed from a nursery for transplanting.

There is no doubt that the best way of preventing the spread of injurious insects is by the fumigation of nursery stock, and a good deal of indignation was manifested by American fruit-growers at the end of the last session of Congress when it was found that a Bill rendering that operation compulsory throughout the country had been shelved by means of the lobbying tactics of a few influential nurserymen. As a rule, however, nurserymen in the United States, for the satisfaction of their customers, are fumigating their trees before sending them out. It would be no real hardship for the minority of mischievously neglectful men to be compelled to fall into line with their fellow nurserymen in a country where scale insects are extremely common and injurious. Fumigation with hydrocyanic acid gas is the cheapest,

as well as the most effectual, process for killing scale and other insects on nursery stock yet discovered.

At the end of a bulletin on "Nursery Fumigation," issued in January last by the Pennsylvania Department of Agriculture, Professor Johnson, who had been commissioned to prepare it, gives a list of points to remember. Nurserymen and others are advised to fumigate all trees before sending them away for transplanting; not to use gas stronger than that which is generated by 0.25 gram of cyanide per cubic foot; never to leave the trees exposed to the gas longer than an hour; never to fumigate the same trees, especially peaches, a second time (meaning a second time shortly after the first); never to fumigate trees when they are thoroughly wet, though they may be damp; not to puddle the roots before the trees are fumigated; never to fumigate trees until the wood is well matured, and the buds are dormant; never to fumigate them after the buds have begun to open in the spring, and not to fumigate buds, grafts, or scions with more than 0.16 gram per cubic foot of space. There are also cautions against leaving the cyanide exposed to the air, or where children can reach it, against allowing the residue to remain long in a jar, against emptying the residue where children (he might have added, or fowls or other creatures) can get at it, against putting a fresh charge into a jar containing residue, against the use of metal vessels for the acid or the mixture, against leaving the door of the fumigatorium open a moment after the cyanide has been dropped into the jars, and against allowing anyone to go close to the door or to open it or enter the house before the ventilators and doors have been open for a quarter of an hour.

It is easy to make arrangements for suspending the bags of cyanide over the jars, and lowering them into the acid and water by means of strings worked from the outside of the house. With ordinary care, the process may be and is used with perfect safety.

#### FUMIGATING IN GREENHOUSES.

The use of hydrocyanic acid gas for the destruction of different insects on various kinds of plants in greenhouses is becoming more and more common in the United States, under the advice of experts as to the strength of gas to be employed for each kind of plant. In the course of their investigations into the diseases of greenhouse plants, Messrs. Woods and Dorsett, of the Division of Vegetable Physiology and Pathology in the Department of Agriculture, found it necessary to destroy the insects living upon plants under observation, and for this

purpose they used hydrocyanic acid gas. The experience they thus obtained led to their being commissioned to prepare a circular for the Division of Entomology, issued in 1899.

In this circular the writers explain that, although the gas had been occasionally tried in greenhouses before they carried out their experiments in 1895, it was not recommended because, owing to the lack of knowledge as to the strength in which it should be employed for various plants, a good deal of injury was done. Their careful and systematic experiments showed that, as a rule, plants were less injured by a short exposure to a relatively large amount of gas than by a long exposure to a comparatively small volume, while the strong dose applied for a short time was the more effective in the destruction of insects.

Different kinds of plants were found to vary greatly in their power of withstanding the poison, and some details are given, for which readers may be referred to Circular 37, Division of Entomology, Department of Agriculture, Washington, 1899.

Among the pests destroyed were leaf-eating larvæ of various kinds, slugs, millipedes, lice, cut-worms, and mealy bugs. Unfortunately the red spider, the worst of all hothouse pests, in our own country at any rate, was not entirely destroyed by a single application of the gas, and two or three fumigations at intervals would be necessary to clear a house of this enemy, even if complete success could thus be attained. Further experiments are required in this direction.

The writers state that the gas has been used successfully for mealy bugs on "grapes under glass" in New Zealand, without injury to the "plants." It is not clear, however, whether the word "grapes" in this case is not used to mean vines, and it is important to learn whether the gas would injure the fruit in any or all of its stages. Professor Johnson is of opinion that it would not have any injurious effect upon the grapes; but in this case his opinion is not based upon experience.

Some fear having been expressed by an extensive hothouse owner in England as to the possibility of the gas condensing upon fruit or foliage, and being dangerous to consumers of fruit or workers among the foliage of various plants, Professor Johnson states that the gas does not condense, and that there is no danger whatever in the directions referred to.

Messrs. Woods and Dorsett recommend the use of one jar to every 50 feet run of a hothouse, but do not mention the width. They also caution operators to use the string arrangement already noticed for dropping the cyanide into the jars. The cubic contents of a house should be carefully determined, and it should be made as nearly gastight as possible. It is a good

plan to water the outside of the house, as the water closes many cracks. Operations should be carried on after dusk, and it should be arranged that the ventilators can be opened by a string or wire from the outside when the fumigation has been completed. No one should enter the house until the ventilators have been open at least half an hour. It may be added that the doors also should be opened.

The latest reference to this subject published by the department is a report on experiments with the gas in green-houses for the extermination of mealy bugs and other insect pests, by Mr. H. D. Hemenway, given in Bulletin 22, New Series, Division of Entomology, 1,900. The details are too voluminous to be repeated in this article; but most of the experiments were entirely successful, several descriptions of insects on a great variety of plants being destroyed without injury to the plants. Messrs. Galloway, Woods, and Dorsett, however, to whom the report was submitted by the Division of Entomology, append a disquieting statement of opinion, to the effect that plants not injured in one part of the country and at a particular season would not necessarily be unharmed in another district or at a different time. Apparently, then, a great deal more research will be necessary before the fumigation of hot-houses with hydrocyanic acid gas can be safely practised on a large scale, without small preliminary local and seasonal trials on each description of plant to be treated.

#### THE USE OF THE GAS IN CORN GRANARIES, MILLS, AND OTHER BUILDINGS.

In the *Rural New Yorker* of February 10, 1900, Professor Johnson describes his discovery of the efficacy of hydrocyanic acid gas for the destruction of weevils and other pests in corn granaries and flour mills. In showing a nurseryman how to generate the gas, it occurred to him that, rather than waste it, he would use it in a granary where insects were secluded in cracks and crevices. After the operation, the first thing to meet the eye was a dead mouse, and further inspection showed that the floor in many places was literally covered with the dead bodies of the saw-toothed grain moth (*Sylvanus surinamensis*). This was the origin of systematic experiments in mills and granaries, the first of which was carried out by Professor Johnson in a three-storey brick mill in Pennsylvania in June 1899. This mill was badly infested with the weevil. The next trial was in a mill overrun with the flour moth. In both cases the owners declared that the trials were completely successful. The

quantity of cyanide used was 0·2 gram per cubic foot of space, as in fumigating outdoor fruit trees, and the acid and water were used in the proportions already given in relation to cyanide.

In fumigating a building of more than one storey, the top floor should be treated first, as the gas rises. After the charge has been set on the top floor, the operator should descend quickly and treat the next, and so on till he has done the lowest floor.

Dr. Townsend, State Pathologist for Maryland, who has investigated the subject, declares that there is not the slightest danger of the contents of mills or granaries being harmed for either edible or germinative purposes by the gas.

Buildings have also been cleared of rats and of the parasites of fowls and human beings by the application of hydrocyanic acid gas, which is employed regularly in South Africa, Professor Johnson states, to destroy bed-bugs in railway carriages.

#### FUMIGATION WITH BISULPHIDE OF CARBON.

The vapour of bisulphide of carbon<sup>1</sup> has been successfully tried to destroy insects on low-lying plants or underground in the United States. Boxes have been placed over melons and squashes, with a saucer containing one or two teaspoonfuls of this volatile liquid, to destroy lice. The vapour has also been used successfully for the fumigation of sweet potatoes infested with the root-borer (*Cylas formicarius*). For insects attacking the roots of plants it is the most effective of known remedies, as its fumes, which are deadly, sink in the soil when it is poured into a hole and covered over. For root-lice of vines, apple trees, and other fruit trees or bushes  $\frac{1}{2}$  oz. of the bisulphide is put into holes made with an iron rod, 10 to 16 inches deep,  $1\frac{1}{2}$  foot apart, and not closer to the trunk than 1 foot. For root maggots a hole 2 to 3 inches from a plant will suffice. It is used also for grain insects, distributed in shallow dishes placed over the bins, which are covered with oilcloth to retain the vapour. The bisulphide is applied at the rate of 1 lb. per ton of grain to be fumigated. Bins or buildings are kept closed for twenty-four to thirty-six hours, and afterwards aired well. This gas is highly explosive, and care must be taken not to let a light, or even a lighted pipe, cigar, or cigarette be taken near it.

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<sup>1</sup> See the report of the Zoologist on the use of bisulphide of carbon Appendix, p. lxiii.—ED.

## FUMIGATION REGULATIONS IN CANADA.

In April 1899 an Act was passed by the Legislature of Ontario rendering compulsory the fumigation with hydrocyanic acid gas, of all nursery stock, excepting evergreens, strawberry plants, bulbs, and bedding plants. The measure is described as "An Act to Prevent the Spread of the San José Scale." The importation into the province of any plant infested with scale is prohibited, and the owners of nurseries are forbidden to send any stock out of their nurseries, other than the excepted kinds, without fumigation with hydrocyanic acid gas. Inspectors were appointed to administer the Act, and it is provided that if an inspector finds scale in any nursery and reports it to the Minister of Agriculture, the Minister may prohibit the owner of the nursery from sending any plant out of it until the inspector has reported that such removal can be made with safety to the public interest. Moreover, if an inspector finds scale in several parts of an orchard or collection of trees or plants, and reports that it is desirable to destroy such stock, the Minister may send a second inspector, and if he confirms the judgment of the first, may direct the destruction of all the trees or plants, paying as compensation a sum not exceeding one-fourth of the value of the stock destroyed; provided that no compensation is to be paid for any tree or plant imported within one year of the period of examination. Anyone suspecting that a plant or tree in his possession is infested with the San José scale is required to report his suspicion to the Minister of Agriculture.

Previous to the passing of the Act, Professor William Loch-head, of the Biological Department of the Ontario Agricultural College at Guelph—to whom I am indebted for much information as to fumigation in Canada—visited Maryland and Washington, by direction of the Minister of Agriculture, for the purpose of inquiring into the merits of the treatment of nursery stock pursued in parts of the United States. He saw the tent system of fumigating trees in the open, and came to the conclusion that it would not be practicable in Ontario, as the infested trees in that province are much larger than those which he saw treated in the United States, and the tents would be too difficult to handle and too expensive to fill. Consequently, he says, fumigation in Ontario is applied to nursery stock only, nothing having been done in the line of outside treatment. Moreover, the gas is used only for the San José scale, though, indirectly, much benefit is effected by the destruction of many other insects also.

In the Annual Report of the Ontario Agricultural College for 1899, Professor Lochhead states that, on the passing of the Fumigation Act, he was directed to take charge of the work of inaugurating the system in specially constructed and air-tight buildings. With the assistance of Professors Harrison, Reynolds, and Shuttleworth, all the nurseries in Ontario were visited, and nurserymen were instructed how to build suitable fumigating houses, and how to use the gas. The chemicals required were sent from the college. Nearly a month in the spring was occupied in the inspection of nurseries, and a considerable time during the autumn in the fumigation of nursery stock.

In an illustrated pamphlet, entitled "The San José and other Scale Insects," written by Professor Lochhead, and issued in March last by the Ontario Department of Agriculture "for the use of fruit-growers and scale inspectors," full information is given as to the probable original home, spread, destructiveness, and life history of each of these pests, and as to the treatment recommended for them. In this treatise it is stated that the San José scale has been found on white and black currants; on some forest trees, including the elm, basswood, white ash, mountain ash, birch, and willow; also on rhubarb, hemp, the sunflower, the rose, the spiræa, and several weeds.

According to Professor Johnson, there were seventy fumigating houses in operation in Ontario at the beginning of the present year.

#### THE GAS TREATMENT IN CAPE COLONY.

The Cape was the pioneer of British Colonies in the work of fumigation with hydrocyanic acid gas. From a report on "Gas Treatment for Scale Insects," prepared in 1897 by Mr. Lounsbury, Government Entomologist, for the Horticultural Board, and obligingly sent to me with other sources of information by the Cape Department of Agriculture, fumigation was introduced in the colony in 1893 or 1894. Mr. P. J. Lillie, who had visited California as a delegate of the Cape Government in the former year, to acquire information useful to fruit-growers, had a few tents prepared shortly after his return, and fully demonstrated the superiority of fumigation to spraying. In March 1896 the Horticultural Board resolved to endeavour to popularise the gas treatment by applying funds placed at its disposal by the Cape Parliament to extensive demonstrations. Accordingly, with the permission of the Department of Agriculture, the Government Entomologist was instructed to fumigate the citrous orchards of Wellington. These orchards were seriously

infested with scale insects, and during three months ending with November 1896 about 2,000 trees were treated on twenty-three farms at the nominal charge of 3*d.* per tree, which was increased afterwards to 6*d.* for a tree under 8 feet in height, and 1*s.* for each loftier tree. Other districts of the Cape were visited subsequently, and over 6,000 trees had been fumigated when Mr. Lounsbury wrote his report.

The tent system was used in these experiments, and when the gas was applied in sufficient strength and under a tight tent, every scale insect appeared to be destroyed. The results, however, were not uniformly successful, though the unlooked for result of the destruction of eggs as well as insects was attained in treating trees suffering from the purple scale. In this connection it is stated that, in the fumigating chamber owned by the Department of Agriculture in Cape Town, gas sufficiently strong killed every kind of scale insect and every egg.

Notwithstanding the efficacy of the gas treatment, it was found impossible to exterminate the red scale where it had long been established, as it infests fruit trees other than those of the citrous species, and many garden plants and ornamental trees as well, so that even when the citrous trees were cleansed, they were certain to be re-infested sooner or later.

In March 1896 a proclamation by the Governor of the Cape was issued, prohibiting the importation of grape vines or cuttings, except by the Government under precautionary measures; all stone-fruit trees, scions, cuttings, grafts, roots, seeds, or fruit from the United States or Canada; and, except subject to inspection previous to landing, all trees and plants other than those absolutely prohibited, and all fruit, tubers, roots, bulbs, or portions thereof. In the event of any noxious insect or plant disease being detected on such inspection, it was ordered that the infested imports and packages containing them should be disinfected by the examining officer, or destroyed if the disinfection was not considered effectual. Nothing of the kind was to be landed without a certificate from the examining officer.

From a notice promulgated by the Department of Agriculture in March 1898, it is obvious that the method of disinfection adopted by the inspectors was that of fumigation, as this document sets forth that storage accommodation for trees, plants, fruit, &c., awaiting examination and fumigation, was provided by the Government. A scale of charges for fumigation, to be paid by the consignee, was appended to this document. It is of interest to notice also the following statement:

"Chemical analysis has shown that all traces of the gas used for fumigating disappear within a few days, and that dormant deciduous trees and fruits are not injured by the treatment." Apparently, then, there is no danger in consuming fruit that has been subjected to the deadly hydrocyanic acid gas.

In his Report for 1898, issued by the Department of Agriculture in May 1899, Mr. Lounsbury refers to the import restrictions as having shielded the colony from many foreign pests. But he urges the necessity of internal regulations also, and regrets the failure of efforts to pass a measure known as the Plant Disease and Insect Pest Bill, in 1895, and of an attempt to introduce the Nurseries' Inspection and Quarantine Bill, drafted by the Horticultural Board, with his assistance, and approved by the fruit-growers at their annual congresses in 1897 and 1898. Mr. Lounsbury further points out that the restrictions referred to above relate only to imports by sea, and that there are no safeguards against the introduction of infested or diseased products from other States in Africa, which have no protection against foreign pests. Similar regulations to those of Cape Colony are contemplated in Natal, but had not been brought into operation when my latest information was received.

With respect to orchard fumigation, Mr. Lounsbury reported that it had made a good deal of progress, co-operative fumigating clubs having been formed among fruit-growers, assisted by a grant from the Cape Government of 25*l.* each towards an outfit. The number of trees known to have been treated during the year was 24,000, and it was supposed that others might have escaped attention. Some progress had also been made in the fumigation of nursery stock in chambers or brick vaults.

#### FRUIT FUMIGATION IN NEW ZEALAND.

New Zealand appears to have been the first Australasian colony in which fumigation with hydrocyanic acid gas was tried. In his Report to the Secretary of Agriculture for 1895-96 Mr. T. W. Kirk, Government Biologist, referred to some experiments with this gas carried out by Mr. L. Hanlon, of Whangerei, formerly Government Pomologist, for the purpose of killing mealy bugs in vineries. Hothouse grape-growers were almost in despair, Mr. Hanlon stated, in consequence of the ravages of this pest, and he suggested the gas treatment. Two of the largest grape-growers adopted the advice, and experiments were carried out on a small scale, and with weak gas at first. At last a house containing 24,000 cubic feet was fumigated with gas produced from 6 lb. of potassium cyanide, 7½ lb. of sulphuric

acid, and  $7\frac{1}{2}$  lb. of water. The same quantity of cyanide as of each of the other materials was applied; but, owing to hurry to get out of the way of the fumes, the quantity dissolved was only 6 lb. As the result was "very satisfactory," it may be assumed that the grapes were not injured, though all the mealy bugs, except a few shielded by the bark of vines, were killed. Unfortunately, the stage which the grapes had reached is not stated. Mr. Hanlon recommends the fumigation of vineries with  $\frac{1}{3}$  oz. of 98 per cent. cyanide,  $\frac{1}{3}$  oz. of sulphuric acid, and  $\frac{1}{3}$  oz. of water per 100 cubic feet. The work should be done at dusk, the houses remaining closed for the night. As many separate jars are desirable as are required, allowing  $2\frac{1}{2}$  oz. of each ingredient per jar. If the house is badly infested, it will require a second fumigation to destroy bugs hatched from eggs existing when the first treatment was carried out. If, however, the second administration of gas is effected before the insects are mature enough to lay eggs, it should effectually clear the house for the season.

But it is chiefly for securing New Zealand fruit-growers against scale insects on fruit from abroad that the gas treatment is adopted in the colony. In 1897 Mr. Kirk recommended that the regulations for the inspection of imported fruit, carried out for some years, should be increased by the addition of orders for the treatment of imported citrous fruit found infested with scale insects. The suggestion was at once adopted, Orders in Council being issued prohibiting the importation of plants and fruit affected by any species of scale insect or by Queensland fruit-flies; also of vine cuttings infested with the phylloxera, and fruit attacked by the codlin moth. In his Report for 1898-99 Mr. Kirk states that fumigating sheds were being erected at Auckland, Wellington, Christchurch, and Dunedin, and in these fruit infested with scale insects has since been fumigated with hydrocyanic acid gas. Mr. Kirk adds that the fruit is not injured by the treatment. Indeed, it is greatly improved in appearance.

It was further intended, Mr. Kirk proceeded to remark, to admit fruit and plants from Australia with a Government certificate declaring that they have been properly treated with the gas before being shipped to New Zealand.

#### THE FUMIGATION OF IMPORTED PLANTS AND TREES IN VICTORIA.

In reply to an inquiry sent to the Secretary for Agriculture in Victoria, I have been favoured with the statement that only

imported plants and trees are treated with hydrocyanic acid gas in that colony. For this purpose a fumigating house has been constructed by the Department of Agriculture in the Horticultural Gardens under its control. Trees in orchards are not treated, chiefly because of the expense. Imported fruit is inspected, and, if found diseased with fungi or infested with scale or other insects, is rejected or destroyed. It is not fumigated, the Secretary for Agriculture says, for many reasons, the chief of which is that to admit it subject to such treatment might make Victoria a dumping ground for diseased and dirty fruit.

Under the Vegetation Diseases Act of 1896 the Governor has power, by proclamation, to regulate or prohibit the importation of trees, plants, fruit, or vegetables.

#### THE TREATMENT OF EXPORTED FRUIT IN NEW SOUTH WALES.

Information obligingly furnished by the Department of Mines and Agriculture of New South Wales is to the effect that the fumigation of imported fruit and nursery stock is not compulsory in that colony, but that other colonies require such stock and citrous fruits produced in New South Wales to be fumigated before it is exported to them.

In the communication was enclosed a copy of instructions from the Minister for Mines and Agriculture, apparently carried in the autumn of 1891, as follows, in reference to the fumigation of fruit for export :—

1. Anyone who wishes to erect a chamber or building for the fumigating of fruit is requested to give notice to the Under-Secretary for Agriculture, who will take steps to see that the chamber or building is properly constructed.

2. When it is required to fumigate fruit for export twenty-four hours' notice must be given to the Under-Secretary.

3. The operation of fumigating must be conducted under the control of an officer authorised by the Minister for Agriculture.

4. The fumigating chamber may be made of any convenient size or material, the essential point being that it shall be capable of being closed absolutely air-tight and provided with a flue-pipe in the roof which can be opened or closed to allow of the escape of the gas after fumigation. The flue must be provided with a box or chamber to contain caustic soda or potash to destroy the gas.

The door of the fumigating chamber must be provided with a shutter or sliding panel in the lower portion.

Door, flue, and shutter must all be made to close absolutely air-tight.

NOTE.—A good model for such a chamber may be seen at the Agricultural Museum in the Domain.

This is followed by full directions for fumigating with hydrocyanic acid gas.

In the official *Agricultural Gazette of New South Wales* for October 1898, Mr. F. B. Guthrie described some successful experiments with hydrocyanic acid gas for the destruction of scale on oranges, lemons, and apples. The fruit was not injured, whereas oranges fumigated with sulphur fumes were spoiled for market.

#### EARLY EXPERIMENTS IN SOUTH AUSTRALIA.

Mr. George Quinn, Inspector of Fruit in South Australia, began a series of experiments in the fumigation of citrous trees under tents with hydrocyanic acid gas at Adelaide as early as August 1896. The results were highly satisfactory when the trees were treated in darkness, and moderately so when the work was done on a cloudy day.

In the Report of the Minister of Agriculture for 1898-99, Mr. Quinn, in his divisional contribution, stated that, on his suggestion, a fumigating house had been erected at Port Adelaide, for the purpose of destroying the scale insects invariably found in cargoes of fruit from southern Europe. After July 1, 1899, he added, all imported plants would be fumigated, their introduction being limited to Adelaide and Port Adelaide.

#### HOthouse FUMIGATION IN FRANCE.

For information as to the extent to which fumigation is carried on in France I am indebted to the courtesy of Messrs. Vilmorin, Andrieux, & Co., of Paris. Their communication is so interesting that it is best given in their own words:—

In this country fumigations, as far as known to us, are almost altogether confined to hothouses. Experiments in the open ground, like those we have seen described in the American papers, have not been attempted here, as far as we can ascertain, nor does it appear that there is a great need for them, which to some extent may be ascribed to climatic circumstances. In fact, the fearful ravages of some pests, as reported in the American papers, are almost unknown here, and even in glass-houses the destruction of insect pests or micro-organisms, seems to be far less imperative with us than it appears to be in England.

In France, the solid and the liquid residue of tobacco, which can easily be procured at acceptable prices from the Government manufacturers, are the materials most used in hothouses, both being burned so as to produce the largest amount of vapour. But the liquid residue, or juice of tobacco, is also largely used for spraying both indoors and out of doors. Sulphate of iron and sulphate of copper, Bordeaux mixture, &c., are very largely employed for spraying a number of plants, trees, vines, whole crops, &c., but this does not appear to come within the scope of your inquiry.

As regards carbon bisulphide, this has been repeatedly recommended for the phylloxera and other insects, and it appears to have proved successful

in many cases; however, its use does not spread much, as far as we have heard, probably on account of the complication resulting from the sterilisation of the soil, through the destruction of all the microbes, useful ones and others alike, reached by the vapours of the drug. The latter is mostly used in direct underground injections, but also to a limited extent, in the shape of capsules of various sizes, which are easier to deal with, can readily be procured, but are much dearer.

#### FUMIGATION WITH TOBACCO IN BELGIUM.

M. Pynaert, of Gand, a high authority on horticulture in Belgium, and Editor of the *Revue de l'Horticulture Belge*, has favoured me with replies to questions relating to the practice of fumigation in that important source of hothouse fruit, plants, and flowers. The practice is very common in hothouses; but tobacco leaves alone are used, my informant says, for the purpose, probably because they are very cheap in Belgium.

#### EXPERIMENTS IN ENGLAND.

As stated at the commencement of this article, the only method of fumigation for the destruction of injurious insects practised in this country, until quite recently, has been that of burning sulphur, tobacco, or some preparation of nicotine, and even this practice has been common only in greenhouses. The fumes of sulphur are still, probably, the most effectual destroyers of that great plague of vine-growers, the red spider, and they are more or less deadly to many other insects. The burning of coarse tobacco is a very old practice; but in this country it has been superseded to a great extent by the use of preparations of nicotine. These may be briefly disposed of before experiments in more recent methods of fumigation are noticed.

A preparation of tobacco known as "XL All," sent out by Mr. G. H. Richards, of Southwark Street, London, has come into very extensive use among nurserymen and gardeners. It is in liquid form, and is vapourised in fumigators by means of spirit-lamps. It is used for the destruction of aphides, thrips, mealy bugs, scales, and other insects. This preparation of nicotine is much more convenient to use, and more certain in its effects, than crude tobacco. Other forms of fumigation are afforded by means of McDougall's sheets of cellulose, saturated with nicotine, and the "fumers" sent out by the same firm, in which some preparation is evaporated by the burning of a wick placed under it. The sheets are used out of doors under textile coverings, as well as in greenhouses.

Apparently Messrs. Alexander Cross & Sons, of Glasgow and London, were the first to introduce fumigation with hydro-

cyanic acid gas commercially in Great Britain. They prepare vapourising powders, under the name of "Necros," for producing the gas; but a small spirit-stove is required to effect the vapourising, which strikes me as a disadvantage, as compared with the use of the crude materials. Apparently the directions as to the quantity of powder to be used for a given number of cubic feet of space are so arranged that the gas will not be too strong for delicate hothouse plants, as only one prescription is given. This raises the question whether the gas would be strong enough to kill some insects. The powders have been used successfully for mealy bugs, thrips, and aphides on several kinds of plants. Experience proves, however, that various species of plants, and even the same plants in their several stages, need to be treated with widely different strengths of gas; and growers of hothouse fruit and flowers may be advised to experiment only on a very small scale, until they learn how much gas can safely be administered in each instance.

The owner of one of the most extensive hothouse nurseries in the world objects to fumigation with hydrocyanic acid gas for three reasons. First, he fears that accidents to the administrators may occur; secondly, that the gas may condense on fruit and foliage, and injure consumers of the fruit and workers among the foliage; and in the third place, that the cost of fumigation with this gas is too high. The answers to these objections are that, although the fumigation has been carried on in the United States for many years, and in other countries for shorter periods, no loss of life or serious injury from it has been reported; that the gas does not condense, and that no harm has been known to occur from the consumption of fumigated fruit in the countries where oranges, lemons, and even apples are extensively treated; and that fumigation with hydrocyanic acid gas is generally declared by those who use it in different countries to be the cheapest form of effectual fumigation. As to the last point, the cost of the process in this country, where the materials are bought at wholesale prices, is put by an experienced authority at only  $2\frac{1}{2}d.$  per thousand cubic feet. One authority states that this is less than half the cost of fumigation with sulphur.

*Experiments at Wye College.*—The only systematic experiments with hydrocyanic acid gas carried out in this country and publicly reported are those which have been and are still being conducted by Mr. H. H. Cousins and Mr. F. V. Theobald, of the South-Eastern Agricultural College, Wye, Kent. The Journal of the College issued in April last contains a report of some of these experiments.

To notice first the trials which are of less importance to fruit-growers in this country than others to be hereafter described, they include the treatment of vineries infested with mealy bugs. The first vinery, with a capacity of 3,430 cubic feet, was fumigated with 18 oz. of potassium cyanide, 27 fluid ounces of sulphuric acid, and 1 quart of water, after sunset, at a period when the vines were in full bloom. All the developed mealy bugs appeared to be destroyed, and the foliage of the vines was not harmed; but three-fourths of the blooms were injured. A few of the insects appeared at the end of the season, after the grapes had been gathered, and a second fumigation was given, with successful results.

In the next trial, although 27 oz. of cyanide, 40 fluid ounces of acid, and 60 oz. of water were used in a house of 3,825 cubic feet, no injury was done to the vines, as they had not bloomed, while all the mealy bugs appeared to be cleared off. In this case also a few of the pests showed up in the autumn, but were destroyed by a second fumigation.

In the third case the grapes, which were of the size of peas, were killed with the bugs. Apparently other experiments in vineries were carried out, as Mr. Cousins recommends fumigation before the vines bloom, when the grapes are colouring, or after the crop has been gathered, as no harm, he says, results in any of these stages. In the reported experiments there is no mention of the fumigation of vines when the grapes were colouring, but Mr. Cousins informs me that he applied the gas in one house of ripe grapes and found no injury done to the fruit.

Other experiments were carried out in hothouses containing in one case chrysanthemums in full bloom, infested with aphides; and, in the other, mixed flowers and ornamental plants covered with mealy bugs and aphides. In both cases the success was complete, the pest being destroyed without injury to flowers or foliage. In the chrysanthemum house slugs, flies, wasps, and butterflies were killed, as well as the green aphids, while a toad was not injured. In this house of 2,000 cubic feet  $3\frac{1}{2}$  oz. of cyanide, 5 oz. of acid, and 9 oz. of water were used; in the house of mixed plants, 3,000 cubic feet in capacity, 8 oz. of cyanide, 12 oz. of acid, and 20 oz. of water.

On the basis of his experience of fumigation in greenhouses, Mr. Cousins makes some recommendations which are condensed as follows:—

One fumigating vessel (a glazed earthenware pot or jar) will suffice for each 10,000 cubic feet of space.

The ventilators should be arranged so that they can be opened from without.

Place the water in the jar first; next add the acid; and, lastly, drop

the cyanide, enclosed in blotting-paper, into the liquid by means of a pole and string actuated from the outside of the house.

Fumigate when the foliage is dry, when the temperature of the house is not over 60° F. (preferably not over 50°), and after sunset.

Open all the ventilators and doors after the prescribed time (40 to 60 minutes), and on no account enter the house within one hour.

For mealy bug in vineries the prescription is 3 oz. of cyanide, 5 oz. of acid, and 8 oz. of water per 1,000 cubic feet; for ordinary greenhouse pests, such as the aphid, white-fly, slug, woodlouse, red spider, and caterpillar, 1½ oz. to 2 oz. of cyanide, 4 oz. of acid, and 7 oz. of water per 1,000 cubic feet.

The question arises, however, whether this dose would be safe for all descriptions of hothouse plants. Roses, for example, have proved peculiarly susceptible to injury from fumes which did not harm other flowers in the same house with them. A great many more experiments than have been carried out with hydrocyanic acid gas in hothouses will be necessary before safe prescriptions for specified plants or lists of plants can be safely given.

*Death to the Black-Currant Mite.*—We now come to the most important result of Mr. Cousins's experiments with hydrocyanic acid gas. This is the destruction of that terrible enemy of the fruit-grower, the black-currant mite. Like the Boer, this foe is usually found in the shelter of an entrenchment, and, for that reason, has been extremely difficult to encounter. Within the folds of the bud, indeed, the mite had proved invulnerable to all insecticides which did not kill the bud with it, until Mr. Cousins conceived the happy thought of trying the effect of hydrocyanic acid gas upon it.

In the first week of January last, when there were no mites' eggs to complicate the trial, two thousand young black currant bushes, badly infested with the mite, were taken from the nursery ground in which they had been raised for fumigation previous to transplanting in their permanent quarters. They were in such a bad condition that their grower would have destroyed them, as he considered them worse than worthless for transplanting. Tied in bundles, they were placed in a heap on the ground, and fumigated with hydrocyanic acid gas under an oiled cloth supported by four hurdles, and kept close to the ground around the hurdles by pieces of wood placed upon its edges.

After being fumigated for an hour, the bushes were removed, and a number of the affected buds were subjected to microscopic examination by Mr. Theobald. Thousands of dead mites were found, but not one living. A second lot of bushes was similarly treated a fortnight later, with the same result.

All the fumigated bushes were planted out in mite-free soil,

and about four months later they were still quite free from living mites.

Another trial was the fumigation of large growing bushes, about one-fourteenth of an ounce of cyanide being used per cubic foot of space under the coverings. All the mites were destroyed, the time during which the bushes were fumigated being forty minutes, which probably would have been sufficient for the bundles of young bushes.

Further it was proposed to test a more extensive plan of field-work. Six lengths of oiled calico, 25 yards by 8 feet, eighteen jam pots, and a supply of chemicals, it was calculated, would enable a man and a boy to fumigate two-thirds of an acre of established black currants in a day. Each length of 25 yards would require three pots, each holding 1 oz. of cyanide, 2 oz. of acid, and 2 oz. of water, and the chemicals would cost about 50s. an acre. The oiled calico may be simply placed over the bushes, without supports, though, it is to be presumed, it should be weighed down to the land with clods or stones, or anything convenient.

It remains to be seen whether the old standing bushes will keep free from mites, or whether they will become re-infested from mites in the soil. But even if old bushes cannot be permanently cured, the discovery of the efficacy of hydrocyanic acid gas for the destruction of bud mites is of very great value, as it will enable fruit-growers to obtain mite-free bushes to plant out in fresh soil, to take the places of old and infested plantations which can be destroyed. In this way, what was once one of the most profitable of fruit crops, made unprofitable in many cases by the mite, so that many hundreds of acres have been grubbed up, may be rendered satisfactory again.

There is no doubt that the use of hydrocyanic acid gas for nursery stock is the most important of all its functions in relation to fruit and plant growing, and even to forestry, although the experiments carried out with forest trees have been few in number.

Mr. Cousins has experimented also with carbon bisulphide for the destruction of wireworms, and he recommends it for sterilising soil for greenhouses. As stated in references to American experiments, it is the most certain means of killing underground grubs or insects, while it is used also to destroy insects in corn granaries and flour mills, and weevils in beans and peas for seed.

A suggestion may be made in reference to this material for producing poisonous fumes which sink into the soil. It has already been remarked that there is reason to fear that old-established black currant bushes, cleansed of mites by hydro-

cyanic acid gas, will become re-infested by mites harboured in the soil or on weeds upon it. Possibly, then, fumigation with carbon bisulphide on the surface of the soil might be fatal to such harboured mites. Indeed, it may be that fumigation with this liquid would be found fatal to mites in bushes, and in the soil alike, so that all might be killed in one operation, dispensing with the hydrocyanic acid gas.

The principal objection to the use of carbon bisulphide, as stated by the French authorities quoted in a preceding portion of this article, is that it destroys valuable, as well as injurious, insects, grubs, and micro-organisms in the soil, so far as it reaches them. In short, it would go far towards sterilising the surface of the soil, if used over the surface, instead of only in holes. This objection might not weigh against the advantage of completely destroying the mites in, under, and between infested black currant bushes, once for all, supposing that its use proved thus effectual, as the loss of fertility could be restored artificially. But the objection seems fatal to any plan of regularly and repeatedly using the bisulphide to destroy soil pests, even in hothouses. A minor objection is the extremely explosive character of the gas generated, though, with care, it may be used safely.

#### CONCLUSION.

From the preceding statements it will be seen that there is a great opening for experiments in the fumigation of trees, plants, greenhouses, corn granaries, flour mills, any other buildings in which vermin need to be destroyed, and soil containing underground pests. Moreover, it is highly desirable that such experiments should be carried out by skilled specialists, because the general use of the poisonous gases, which have proved valuable when used with knowledge and care, cannot be recommended for some purposes until distinct prescriptions and regulations, applicable to different subjects and circumstances, have been authoritatively drawn up and published. Sufficient experience has been gained and made public to justify the free application of hydrocyanic acid gas to infested nursery stock of certain kinds, such as hardy fruit trees and bushes, and for trees in the open infested with scale insects; but, for hothouse fruit and flowers, a multitude of systematic experiments will be necessary before their treatment with the deadly gas can be recommended to growers. Nevertheless, the successes with the gas already recorded are so numerous and multiform, that a widely extended sphere of usefulness for fumigation may be confidently anticipated.

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## REAPING MACHINES, PAST AND PRESENT.

"NECESSITY is the mother of invention," and a truly prolific parent has she been, whilst, so far from there being any sign of feebleness or exhaustion, her vigour continues unabated. The self-binding reaper is not the least important and valuable addition of recent years to her large family. It is not proposed, however, to review at any length the history of the reaping machine, and this for one or two reasons.

Firstly, because from the year 1834, when the late Cyrus McCormick of Virginia brought out his first machine, up to the present time the Royal Agricultural Society has always been fully alive to the extreme importance of his invention, as is proved by the numerous trials that have been held by the Society at short intervals in different parts of England, and the substantial prizes that have been offered for competition. These trials have all been fully reported in the Society's Journals, and a mere recapitulation is neither necessary nor desirable. It may be useful, however, to refer readers to vol. iv., 3rd series, 1893, p. 702, where the place and date of each trial, with the volume containing the report thereon are noted. It is sufficient here to recall that from 1852 to 1876 there were eleven trials of reaping machines, and that since then there have been already five trials of self-binders, viz.: in 1877 at Liverpool, in 1878 at Bristol, in 1881 at Derby, in 1884 at Shrewsbury, and in 1893 at Chester.

Secondly, many of those who read this Journal will have had a good deal of practical experience in using the various types of earlier reaping machines—back hand delivery, side swathe delivery, and side sheaf delivery—and it will be admitted that each of these has done good service in the past, and will continue to do so for a long time to come.

There is much food for reflection on reading the reports of past trials. We have nothing now half so imposing as the mighty Crosskill reaper, cutting a 12-foot swathe, and pushed by an 8-horse-power Aveling and Porter traction engine—a formidable procession requiring a 30-acre field for the day's operations. This combination was entered for the Leamington reaper trials in 1876, and, judging from Mr.

Hannan's report, seems to have done good work, which filled the spectators with awestruck admiration. The Society awarded their gold medal to this enterprising exhibit, and therefore it must have been thought at the time that a useful career was before it.

It would be interesting to know the subsequent history of this reaper, because, in spite of such an obvious drawback as the weight of the propelling engine, the advantages are equally obvious, as seen in an immense capacity for work— $2\frac{1}{2}$  acres an hour, we are told, and on a gradient in some places of 1 in 10, working without spikes. Besides, in real harvest weather the weight of the engine would probably do no harm. After a lapse of twenty-four years, perhaps it will not be thought invidious to recall the fact that at these trials (in 1876), out of a total of fifteen awards, Messrs. Richard Hornsby & Sons, of Grantham, secured twelve in various classes—a great performance, and one that has been well sustained by this firm in more recent trials, and up to the present time. All the earlier binders tied with wire, and from a mechanical point of view possibly there was no objection to its use. From an agricultural standpoint, however, the objection was serious, as there was always a risk of the wire bands getting into and damaging the threshing machine; and, if it escaped the thresher, there was a probability of injury to milling machinery, and to the chaff cutter. Last, but not least, if the wire should be swallowed by human beings or stock, the result might be fatal. Nevertheless, it is interesting to note in this connection that Mr. Hannan in his report (vol. xiv., 2nd series, 1878, p. 131) evidently thinks that the objections to the use of wire are not so serious as represented, and is sceptical as to the probability of string superseding its use. We know now, however, that, under the inexorable law of "the survival of the fittest," wire has altogether failed to retain its place.

Two string binders were exhibited at Liverpool—one by Mr. Neale and the other by Mr. King. The former is favourably noticed by Mr. Hannan, but neither of these machines took part in the trials at Aigburth, and to none of the three American wire binders—McCormick, Wood, and Osbourne—that competed did the Judges feel justified in awarding the gold medal of the Society.

At Bristol, in 1878, four wire binders were entered for competition, and three string binders. Of the former, three actually went through the trials at Abbots Leigh in August, viz.: W. A. Wood, McCormick, and Messrs J. & F. Howard. Of the latter, only one underwent the trials, that of the Johnson

Harvester Co., who at the request of the Judges worked their machine sufficiently to demonstrate the practical possibility of securing mechanical *string* binding. At these trials the gold medal was awarded to McCormick. At Derby, in 1881, the Council of the Society determined to offer a gold medal for the best binder with material other than wire. This important decision was well responded to, and there were thirteen entries of combined reapers and binders, and three of gleaners and binders intended to follow a side sheaf or swathe delivery reaper. It seems a pity that these latter machines were not able on this occasion, or indeed since, to give a better account of themselves, because, as Mr. Coleman remarks (vol. xviii., 2nd series, 1882, p. 265), "under some conditions separate operations are preferable" in order to allow an interval to intervene for drying, when for instance the corn is unripe, or there is a strong growth of clover or possibly of weeds in the crop. The fact remains, however, that they have not secured the public favour, presumably because they are not urgently demanded.

With regard to the thirteen self-binding reapers, it is satisfactory to note a more determined English effort to challenge the American makers, who up till now had taken a strong lead in this line of engineering. The reason of this is not far to seek, and it affords no reflection on the ability or enterprise of our English firms. It was rather that the powerful stimulus of *necessity* came earlier into play on the other side of the Atlantic, in the shape of very scarce and dear labour, large areas of corn to cut less hampered by enclosures, the crops lighter and standing better than in England, a more certain climate, and less liability to the heavy draught caused by bad weather to which we are more or less accustomed.

The earlier American binders were of course built to deal with these ideal conditions, and no doubt successfully, but it soon became evident that, to cope with the somewhat opposite conditions of an average English harvest—viz. : heavier crops, longer straw, not usually standing straight, and seldom quite dry, the ground often not sufficiently hard, and the land rarely quite clean—considerable modification in the matter of strength and capacity would be needed to enable their machines to meet our requirements. To do our cousins justice they have not been slow to see what is wanted and to make the necessary alterations, with the result that they still maintain their reputation for ingenuity, high-class workmanship, and quality of materials used in construction, whilst they rank with the best of our own makers both in efficiency and in cost. Only eight machines took part in the Derby trials, seven being self-binding

reapers, and one a gleaner and binder. The gold medal was awarded to McCormick, and a silver medal each to Samuelson & Co. and the Johnson Harvester Co. At the Shrewsbury trials, in 1884, eight exhibitors entered seventeen machines. These comprised three each by Hornsby, Howard, and McCormick, two each by Kearsley, Wood, and Samuelson, one by Johnson, and one by King & Evans. After exhaustive tests the first prize of 100*l.* was awarded to Messrs. Richard Hornsby & Sons, and the second prize of 50*l.* to Messrs J. & F. Howard.

Mr. Thomas Bell in his report of these trials (vol. xxi., 2nd series, 1885, p. 51), in describing some special details of construction in the first prize machine, draws attention to the fact that the underside of the platform next the finger bar is made almost flush with the fingers, the woodwork being protected by sheet iron close up to the fingers, and by this means avoiding the square angle behind the finger bar next the ground, which in some machines is a very serious obstruction and the cause of half the stops and bad work, especially where the land is uneven, soft, cloddy, or dirty. It is wonderful what a difference this point alone will make in preventing stoppages to clear the finger bar, which is not only waste of time, but always means bad and untidy work. It is almost as important to examine this feature in a binder as it is to look in the mouth of a horse you are thinking of buying.

The next trials of binders took place at Chester in 1893, and an interval of nine years gave, as might be expected, time for considerable advance in various directions tending to raise the general standard of efficiency. At these trials I had the honour to act as one of the three Judges, and also to write the report (vol. iv., 3rd series, 1893, p. 702). The weather was very hot, the pace was often too good, and the stops hardly frequent enough, from the pedestrian point of view. Nevertheless, we considered the trials thoroughly conclusive and unanimously awarded the first prize of 50*l.* to Messrs. Hornsby, and divided the second prize of 30*l.* and the third prize of 20*l.* equally between Messrs. Hornsby and the Massey-Harris Co.

The extreme importance of *good separation* was well demonstrated in the case of the first prize machine. This is effected by a special appliance fitted to the Hornsby machine only (see p. 709 of the report, trials with oats, No. 3). In the same trials with oats the Massey-Harris machine clearly proved the great advantage of a smooth surface presented to the ground by the finger bar and cutting platform (see p. 709, No. 8), as alluded to above.

Another point of considerable importance is the much

greater ease and celerity with which the binders can now be shifted from transport to work, and *vice versa*. Formerly this occupied about three-quarters of an hour; now it is done in little over five minutes; and where the enclosures are small this may soon mean a difference of several acres cutting in a season.

The price of self-binders at the present time is very different from that which ruled in the seventies, when 65*l.* was the ordinary figure. In the Shrewsbury year, 1884, the usual price was 45*l.* to 50*l.* At Chester in 1893 it was 45*l.*, and last year at Maidstone 42*l.* It must be remembered that the price has always been in the *inverse ratio* to the efficiency—that is to say, if an old binder was ever worth 65*l.*, a good modern machine ought to be worth about 150*l.*, and this makes it look cheap at 42*l.*

The leading successive improvements have been: (1) the abolition of wire, (2) the reduction of weight, (3) the reduction of draught, some makers now using ball and roller bearings, and (4) the reduction of price, while at the same time the cutting, elevating, sheafing, and separate binding have been greatly improved. When wire first gave place to string, it was feared that the somewhat complicated mechanism required to tie the knot would be a fatal drawback, and render it prohibitive for agricultural purposes. It is therefore curious, but it is a matter of fact, that when an Appleby Knotter, for instance (perhaps the most usual type), is once properly adjusted, few parts of the machine give less trouble in working, and that this has been the case since so far back as 1883 is within the experience of the writer, who that year invested in a Hornsby binder and used it regularly for seven years besides cutting a good deal for hire. It was then sold as a *going concern* for 25*l.*, when the farm was given up. Certainly at times there was a good deal to try the temper; occasionally, indeed, nothing seemed to go right *except the knotter*.

The elevating canvases are a source of trouble, as they often need tightening or slackening, owing to dryness or dampness respectively. There is also very considerable wear and tear on these elevators, travelling as they do at a good speed; and their repair is not exactly the work of any village tradesman, though the carpenter may be able to renew the ash laths, the blacksmith to fix the copper rivets, and the cobbler to repair a strap or buckle; but the best plan is to do these things yourself. Still it might have been expected that these canvases would ere this have given place to some better appliance, but so far they are holding their own.

The best modern binders are under excellent control by the

driver, who by means of the levers within his reach can set the reel up or down, forward or backward, to suit different conditions of crop. He can also alter the tilt of the cutting platform and finger bar, besides having control of the travelling buttor, and also the position of the band on the sheaf, *i.e.* nearer the head or the butt, by shifting the binding platform forward or backward.

So much then for the past. Now what should be our attitude with regard to sheaf binders in their present state of development? It is clear that these machines have come to stay, as they have now been before the public for upwards of a quarter of a century, and this ought to be a sufficient period of probation to satisfy the most cautious, as they would certainly long ere this have been consigned to oblivion, if it had not been a fact that they are reliable machines capable of doing the work they profess to do, and of doing it well.

We must also admit another fact, and that is that the special reason which called binders into existence, *viz.* the difficulty of obtaining manual labour, becomes more acute every day, and at the rate this difficulty is increasing the time is not far distant when there will be no choice in the matter, and the only way to tie corn will be by machinery.

So far as this particular work is concerned, the prospect has already lost much of its terrors, but no doubt in many directions the labour question is difficult enough, and it can only be hoped that machinery will continue to come to the rescue. After all, machinery has many advantages over manual labour. A machine well made, in good order, and well worked, never strikes or argues, but will work continuously just so long as relays of horses and drivers can be found, and daylight lasts—perhaps sixteen or eighteen hours—and requires no refreshment except a little oil. In the matter of tying also, in my opinion the binder has the advantage in several ways.

In the first place, you can tie tightly or loosely by altering the tension of the string, with the certainty that if you tie *loosely* the knot will not come undone, and the sheaf will lift with the fork, and not cause waste of time, and of corn, in tying again by hand, when loading or unloading, which would probably be the case with a sheaf loosely tied by hand. This is an important matter, because corn will often be fit to stack a good deal sooner if not tied too tightly, as the air gets through it better; but under the old régime it would never do to tell the harvest hands to “tie slack,” because half the sheaves would come to pieces.

In the second place, a great point in favour of a string band lies in the fact that in wet weather it does not hold the water like a straw band, and the corn will be fit to stack all the sooner. It is impossible to over-estimate the importance of this feature, because it often happens that corn is fit to stack except for wet at the bands, and by the time it is dry at the bands more rain comes, and the last state is worse than the first.

In the third place, a minor advantage is that no corn is wasted in the bands themselves, and this cannot be said of the old system.

Then, again, when a good binder is working under tolerably favourable circumstances, there is no waste, for there is nothing worth raking, so that this expense is saved, and also the loss of corn which would otherwise have been raked, as rakings are generally more or less spoilt through lying on the ground, and are only fit for poultry.

A binder will of course deliver the corn loose if the string is not used, and it is within my own experience that this method of working is now and then useful.

The exact economy effected by using a binder must be reckoned by every man for himself. Harvest wages may vary to considerable extent in different parts of the country. In the north, woman labour is largely available, with boys to make bands, but the adult male labour is correspondingly dear. It may be said roughly that the binder will displace seven harvest hands, and this may mean anything from a pound to thirty shillings a day. As has already been stated, however, the difficulty at the present time may be to get manual labour at any price, and when this is the case, and the corn is waiting, who shall assess the value of a machine that will render the farmer to some extent independent of harvest hands? In this connection it may not be out of place to quote a passage from the report of the late Mr. John Coleman on the trials of sheaf-binders at Bristol (vol. xv., 2nd series, 1879, p. 108):—

The time is coming, if it has not already arrived, when English farmers must have recourse to labour-saving machinery; and enough has been done (1879) to show that practical efficiency has been obtained. In our Colonies, especially Australia and New Zealand, American sheaf-binders have been largely introduced, and I am informed on credible authority that in certain parts of New Zealand the land has doubled in value in consequence.

If a man like the late Mr. Coleman, who thoroughly understood this subject, so wrote twenty years ago, with how much

more force do his words apply now ! We are, indeed, all well aware that anyone who has corn to cut should use a binder if possible.

Unless what has been stated in this article is untrue, there is a very good chance of recovering the price of the machine, or most of it, in the first season. If you get your corn cut in good time, there is often an opportunity of cutting for hire, at from five to six shillings an acre, the hirer finding horses ; and I know several *grass* farmers who keep two or three binders and drive a very good trade at harvest time in cutting for hire.

It is desirable, perhaps, to get experience by hiring at first, and it is well to see and compare the binders of several different makers at work before deciding which will best meet your own requirements. In the case of small farms it might sometimes be found practicable to share a machine with one or more neighbours, who happened also to be very good friends, otherwise there might be a little difficulty as to who should have "first call."

In the case of a large farmer with a considerable acreage of corn, the purchase of one or more binders can hardly fail to be good policy. It is difficult to say what is the actual acreage of corn that would justify the purchase of a binder. Every man must judge this also for himself ; but supposing the machine cost 50*l.* (and a good one can be had for less than 40*l.*), and supposing it saves one pound a day when at work, less than a week's work would pay good interest on the purchase money, plus depreciation, and therefore it seems as if about 50 or 60 acres would warrant the investment. The fact remains, however, that a man who has given a good binder a fair trial does not often revert to the old system of harvesting, and I must confess that such a case is not within my own experience.

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## THE COMPARATIVE VALUE OF NITRATE OF SODIUM AND SULPHATE OF AMMONIUM AS MANURES.

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SULPHATE of ammonium and nitrate of sodium (commercially known as sulphate of ammonia and nitrate of soda) have long been competitors for the farmer's favour, and the competition is likely to continue, as the market price of each influences the market price of the other. It is clearly important that the farmer should be acquainted with the comparative returns which may be expected from these manures, and with the circumstances under which these returns will vary. Without this knowledge he will be unable to employ them to the greatest profit, or to take advantage of the variations in their market prices.

Sulphate of ammonium and nitrate of sodium are chemically very distinct substances, not one of the proximate constituents of one salt being found in the other. In their use as

manures they become, however, far more alike. While the nitrate of sodium undergoes but little change in the soil, the sulphate of ammonium is profoundly altered. By contact under favourable conditions with a moist soil containing calcium carbonate, the sulphate of ammonium is finally resolved into two salts, the sulphate and nitrate of calcium. The different effects produced by the manures we desire to compare are thus due to two distinct groups of facts—(1) the vicissitudes which these manures undergo in the soil; (2) the differences in the plant food which they finally supply. It will be necessary for us to consider, in the first place, these differences in the character and behaviour of the two salts. We shall then be better able to discuss the differences which have been observed in their effects; the differences of treatment which each requires; and the particular occasions on which each is to be preferred.

#### REACTIONS IN THE SOIL.

**Ammonium Salts.**—If sulphate of ammonium were mixed with a pure quartz sand, or with a raw peat destitute of lime, it would exhibit little or no manurial power, and would probably injure, or even kill, any plants which might be growing on the surface. This would happen even if all the ash constituents required for plant growth were present, provided only that the soil, as already assumed, was destitute of basic substances.

So serious a deficiency in basic constituents only rarely occurs in cultivated soils, though instances are by no means wanting. Wheeler has lately called attention to a class of acid upland soils in Rhode Island, U.S.A., on which sulphate of ammonium greatly injures the growing crops. On applying lime to these soils the poisonous effect of the salt ceases, and it acts in its usual manner as a beneficial manure. On soils which have become impoverished in lime by long cultivation the same injurious effect of ammonium salts may sometimes be perceived: this has been observed on certain plots in the Rothamsted grass experiments, and in the later years of the experiment on the continuous growth of barley at Woburn. In all such cases the faulty condition of the soil may be cured by the application of a dressing of chalk or lime. On land standing in great need of lime, nitrate of sodium will give a much better return than salts of ammonium.

Another circumstance which may diminish the effectiveness of ammonium salts must also be referred to in passing, though also of somewhat limited occurrence. In the case of calcareous soils, there is a danger of losing ammonia by volatilisa-

tion. The ammonium salt is decomposed by the carbonate of calcium, and carbonate of ammonium is produced, a part of which escapes into the air. The danger is clearly greatest when the ammonium salt is applied as a top-dressing, and remains some time on the surface during the absence of rain. The danger is greatly diminished when the ammonium salt is mixed with superphosphate, and when the manure is ploughed or harrowed in, so as to be quickly covered by a layer of moist soil. The existence of a possible danger of the kind just indicated should never, however, be forgotten by a farmer who desires to derive the fullest benefit from the use of sulphate of ammonium.

The first change which an ammonium salt undergoes when brought into contact with a moist fertile soil is due to the chemical reactions which accompany the exercise of the so-called absorptive power of soils. The salt is decomposed, the ammonia is retained on the surface of particles of hydrated silicates, hydrated oxide of iron, or humus, while the acid of the ammonium salt combines with lime or other bases, and the salts thus produced are finally washed out of the soil and appear in the drainage water. Excellent illustrations of these chemical changes are furnished by the alterations in the composition of the drainage water at Rothamsted which follow the application of ammonium salts to the land. These alterations are very remarkable. When heavy rain follows very soon after a dressing of chloride and sulphate of ammonium has been applied to the land, there is found an immediate and large increase of chloride and sulphate of calcium in the drainage water, while the proportion of nitrates is only slightly raised, nitrification having as yet made but little progress.

The reaction just mentioned is the true cause of the advantage which ammonium salts possess over nitrate of sodium whenever very wet weather follows the spring dressings of these manures. The ammonia, while it remains ammonia, is retained by the soil, and the rain only succeeds in removing the acid to which the ammonia was united. The nitric acid of the nitrate of sodium is, on the other hand, not retained by the soil, and may possibly be washed into the subsoil before the crop has been able to appropriate it. In popular teaching the statement is often made that nitrate of sodium is a much more soluble salt than sulphate of ammonium, and that it is owing to this difference in solubility that the first salt is more readily washed out of the surface soil by rain than the latter. This explanation is erroneous. The two salts have a nearly equal solubility; 1 lb. of either dissolves in about 2 lb. of cold water.

The real difference between them lies in the very different behaviour of a fertile soil towards ammonia and towards nitric acid.

The ammonia retained by the soil does not long remain unchanged, the oxidation of the ammonia to nitric acid very soon commences, and continues at varying rates till the whole of the ammonia has undergone this change and has become converted into nitrate of calcium. The temporary protection from the action of percolating water has now ceased, and nitrate of calcium can be removed from the soil by excessive rain as readily as nitrate of sodium. Of this fact again we find ample illustration in the composition of the drainage waters from the manured plots at Rothamsted.<sup>1</sup>

The rate at which the nitrification of ammonia proceeds in the soil is a point of much importance in the discussion of the question before us. The more speedily is the nitrification of the ammonia completed, the more nearly (other conditions being equal) should the effects produced by nitrate of sodium and sulphate of ammonium on the growing crop become alike, a similar supply of nitrates being in this case presented to the crop at a nearly similar date. On the other hand, a very slow nitrification of the ammonium salt at once creates entirely different conditions as to the supply of plant food to those occurring when a corresponding amount of nitrate of sodium has been applied.

Nitrification is most rapid when the soil is in a condition of fine tilth; when it is wet, but not saturated with water; when the temperature of the soil is high; and when it contains a considerable proportion of carbonate of calcium or other basic substance.

At Rothamsted a distinct rise in the proportion of nitrate in the drainage water has been observed forty hours after the ammonium salts had been applied to the land in a wet October. In Schloesing's laboratory experiments, in which powdered soils were wetted with solutions of various salts of ammonium, nitrification was completed in 8 to 15 days, even when very large proportions of the salts were applied. Wagner mixed a very large proportion of sulphate of ammonium with a poor loam, containing only 18 per cent. of water, and found that in a cold room no nitrification had taken place in 24 days, but in 36 days a vigorous commencement had been made. In a warm room a similar mixture of soil and salt showed great progress in nitrification in 12 days. We may probably conclude that in well-tilled soil, and in showery

spring weather, the nitrification of an ordinary small dressing of sulphate of ammonium will usually be completed in two or three weeks; but that in dry weather, or with a deficiency of carbonate of calcium in the soil, the completion of nitrification will be considerably postponed. We should also suppose that the nitrification of an ammonium salt would proceed more rapidly in a soil having the fine tilth employed for such crops as barley and potatoes, than when the salt is applied as a top-dressing to a wheat-field in the spring.<sup>1</sup>

In a soil poor in carbonate of calcium, nitrification will be delayed if superphosphate, kainite, or other salt of potassium is applied with the ammonium salt, as each of the manures just named will appropriate some of the lime in the soil, and thus rob the ammonia of one of the conditions necessary for nitrification.

The more gradual effect of ammonium salts as a manure, as compared with nitrate of sodium, is not, however, entirely due to the time occupied by the nitrification of the ammonia, it is in part due to the deferred nitrification of the soil itself. An application of nitrate of sodium does not apparently interfere with the ordinary course of nitrification in the soil, this goes on as if no nitrate had been employed; but when an ammonium salt is applied to the soil, nitrification seems to proceed first on the ammonia, and the nitrogenous organic matter of the soil in contact with the ammonia is protected for a time from decomposition, and reserved for a later action. This effect of adding ammonium salts to a soil will be distinctly increased if the proportion of carbonate of lime in the soil is very small, so that the immediately available base is used up by the ammonium salts, and a fresh supply is only obtained by subsequent weathering.

The retardation of nitrification in a soil by the use of ammonium salts seems to have been generally overlooked; it is plainly seen, however, in some of Dehérain's laboratory experiments. In Schloesing's examples of intense nitrification, in which large quantities of ammonium salts were mixed with soil and kept in a closed vessel into which oxygen gas was

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<sup>1</sup> In the recently published investigations of Winogradsky and Oméliansky it is shown that the presence of certain kinds of fresh organic matter, as sugar and peptone, will greatly hinder or entirely prevent the nitrification of ammonia. Simpler forms of organic matter, the products of decomposition, as butyrates, acetates, and soluble humates, have much less influence. The practical bearing of these facts is obvious. When studying the effect of ammonium salts on meadowland, or its effect when applied with dung, the delay in nitrification due to the presence of fresh organic matter must be taken into account.

introduced as fast as it was consumed, it was found that when oxygen ceased to be rapidly consumed the quantity of nitrogen in the nitric acid produced was always a little smaller than that in the ammonia which had disappeared; the whole of the nitric acid was thus accounted for by the ammonia, and none was apparently derived from the soil. Schloesing ascertained that the amount of free nitrogen appearing during the experiment was too small to influence the result.

In an experiment of my own, a retardation of the nitrification of soil by ammonium salts was also observed. Two identical weights of the same soil were taken, to one of these a quantity of ammonium salt containing 26 milligrams of nitrogen was added. The soils remained undisturbed for 119 days. The ammonia had then all nitrified. It was found that the manured soil contained 53.3 milligrams of nitrogen as nitric acid, and the unmanured soil 34.5 milligrams. Had the nitrification of the ammonia not interfered with the nitrification of the soil, we should have expected to find  $26 + 34.5$  or 60.5 milligrams of nitrogen as nitrates in the manured soil; what was found was a distinctly smaller quantity. The escape of ammonia was prevented in this experiment, but no determination was made of any free nitrogen evolved, which, however, was unlikely to occur from the moderate state of moisture of the soil. It seems thus highly probable that the ordinary nitrification of a soil is more or less temporarily retarded after the application of ammonium salts, and that a part of the nitrification of the soil occurs later in the season than on land which has been manured with nitrates. We shall see presently that this idea helps a good deal towards the explanation of the influences of weather upon the results yielded by ammonium salts and nitrate of sodium.<sup>1</sup>

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<sup>1</sup> Since the above was written it has been shown by Winogradsky and Omélias that the nitrifying organisms cannot themselves oxidise organic matter, and that the nitrites, produced in the first stage of the nitrification process are formed in every case from pre-existing ammonia. This being the case, we must not suppose that in an unmanured soil the nitrifying organism oxidises the nitrogenous humic matter, and when ammonium salt is added attacks by preference the ammonia. The retardation of the nitrification of the organic matter in a soil which is brought about by the addition of an ammonium salt is due to a different cause. We have just mentioned that the nitrogen in the soil must take the form of ammonia before it can be nitrified; this formation of ammonia is the work of bacteria, but it is also to some extent the result of chemical action (hydrolysis). It appears that the formation of ammonia in a soil is checked by the presence of ammonia. This has been shown by Hébert (*Annales agronomiques* xv. 355). The addition of an ammonium salt to the soil thus serves in some measure to protect the nitrogenous organic matter of the soil from change till the added ammonia has been nitrified.

Another practical result of the nitrification of ammonium salts to which we must call attention is the considerable consumption of the carbonate of calcium, or other basic matter, in the soil, which it involves. Each hundredweight of sulphate of ammonium will consume about  $82\frac{1}{2}$  lb. of carbonate of calcium during the process of the absorption of the ammonia by the soil particles, and another  $82\frac{1}{2}$  lb. will be taken up during the formation of nitrate of calcium. The analyses of the Rothamsted drainage waters by Voelcker and Frankland (*Journal R.A.S.E.*, 1882, p. 11) excellently illustrate the active removal of lime from the soil where ammonium salts are employed as manure.

It is, of course, when ammonium salts are used in large quantities, and are applied to the land every year, as in the experiments at Rothamsted and Woburn, that the waste of carbonate of calcium is most likely to reach a hurtful point. When moderate dressings are employed once or twice in a rotation the danger of unduly diminishing the percentage of lime in the soil is much reduced. It must be borne in mind that the lime thus lost can only be replaced by the use of chalk or burnt lime; no application of gypsum or superphosphate of lime will serve the purpose, as basic lime is in this case required.

The solvent action of ammonium salts upon basic calcium salts may in some cases prove of real advantage. In Jamieson's experiments on the effect of phosphatic manures on turnips, nitrate of sodium beat sulphate of ammonium when both were used with superphosphate, but the ammonium salt did best when the phosphate supplied was in the form of ground coprolite.

**Nitrate of Sodium.**—There is little to be said respecting the chemical reactions of nitrate of sodium in the soil. To a certain limited extent the soda, like the ammonia, will be retained on the surface of the soil particles, and some nitrate of calcium will take the place of the nitrate of sodium; but the absorptive power of soil for soda is so much weaker than that for ammonia that this reaction will be relatively unimportant.

Nitrate of sodium not being liable to retention by the soil is free to distribute itself directly it is brought into contact with it. Not only does it thus get a great start of the ammonium salt when both are applied at the same time as a top-dressing, but it ever afterwards possesses a greater mobility; this is due to the fact that nitrate of sodium has a considerably higher molecular diffusibility in water than the nitrate of calcium

produced by the nitrification of ammonia. According to Marignac's experiments, the diffusion of nitrate of calcium proceeds at about two-thirds the rate of the diffusion of nitrate of sodium, when equal weights of these salts are placed in water under the same conditions.

The speedy distribution of nitrate of sodium in a moist soil is attended both with advantages and disadvantages. It is advantageous as securing the immediate action of the manure. It is advantageous during the period of rapid growth, as the nitrate moves freely towards the roots as they exhaust the nitrate in their immediate vicinity. It is especially advantageous in dry weather, when the supply of available plant food is greatly diminished and movements in the soil become very slow. On the other hand, the distribution of nitrate of sodium may take place in the direction of the subsoil as energetically as in a more useful direction, and when a short rooted crop is grown, and excessive rain falls, a more considerable amount of the manure may be wasted than when an ammonium salt has been employed. The advantage, or disadvantage, of the great mobility of nitrate of sodium is thus determined by the circumstances in which it is used, and among these circumstances the time of application of the manure, and the character of the weather, have a preponderating value.

On some kinds of heavy land a top-dressing of nitrate of sodium has the disagreeable effect of destroying the tilth and rendering the soil sticky; this action was strongly marked in the field at Rothamsted on which the experimental oats were grown, but it has not appeared to an injurious extent in other fields on the same farm. The action is clearly due to the disintegration of the compound particles of the soil, on the existence of which the tilth depends; the clay is separated from the fine sand by the action of the salt, and the sand may be seen lying as a glistening film on the surface of a sticky layer of clay. It is well known that some salts greatly promote the coagulation of clay and the formation of compound particles, while other salts act in a contrary manner. Nitrate of sodium belongs apparently to the latter class. By using along with the nitrate another manure, such as superphosphate of lime, which tends strongly to preserve the coagulated condition of the clay, the injury to the tilth may generally be remedied.

It is quite probable that the disintegration of the compound particles of a soil will increase its retentive power for water, though injuring it in other respects, and the marked power of resisting drought possessed by crops manured with nitrate of

sodium may be more or less owing to a previous accumulation of water in the soil.

#### PLANT FOOD SUPPLIED.

We have already pointed out that while nitrate of sodium and sulphate of ammonium both finally supply the plant with nitrates, yet in the first case the nitric acid is associated with soda, and in the second with lime. Is the supply of soda to the soil and crop which accompanies the use of nitrate of sodium ever the cause of the superior results sometimes obtained from this manure?

Soda is not one of the essential constituents of plant food. It is not found in grain from which the chaff has been removed, but it may occur in distinct quantities in the straw. In the potato tuber it is rarely present, but it occurs in considerable quantity in mangel roots. We may say generally that soda is absent from the perfected products of plant growth, but present in very variable quantity in roots, stems and leaves, the manufacturing apparatus of the plant. Soda cannot take the place of potash in the construction of plant tissue, but it may nevertheless serve useful functions in the laboratories of the plant.

Wagner has made very extensive experiments by means of pot-cultures to ascertain if the soda in nitrate of sodium had any share in determining the amount of the crop obtained; to this end he compared the effects of nitrate of sodium and nitrate of calcium, and tried whether the addition of common salt (chloride of sodium) to sulphate of ammonium increased the yield from this manure. He concludes that the presence of soda in the manure has little power to increase the produce except when the soil is distinctly deficient in potash; but if this is the case, the sodium salt is then the means of securing a greater assimilation of potash by the plant and the production of a distinctly larger crop.

There are several Rothamsted experiments showing a beneficial result from the presence of soda in the manure. The first I will name seems exactly to bear out the conclusion arrived at by Wagner. Two plots in the field devoted to the continuous growth of barley have received no potash as manure since the commencement of the experiment in 1852. During the last thirty years, 1868-97, one plot has annually received superphosphate and ammonium salts, and the other superphosphate and nitrate of sodium. In the first half of this period the average crops of barley grain on these plots were

respectively  $41\frac{1}{2}$  and  $43\frac{3}{4}$  bushels, showing an advantage of barely two bushels to the credit of the nitrate. In the last half of the period, however, the sulphate of ammonium and superphosphate yielded an average of  $32\frac{1}{2}$  bushels, and the nitrate of sodium and superphosphate  $40\frac{3}{4}$  bushels, or a difference of  $8\frac{1}{4}$  bushels in favour of the nitrate. Thus when the exhaustion of potash in the soil began to be felt the nitrate of sodium showed a very distinct superiority. That it was the lack of potash which occasioned the marked reduction of produce on the ammonia plot is made evident by the fact that in the case of another pair of plots also receiving ammonium salts and nitrate of sodium with superphosphate, but to which potash has been continuously applied, the average crop by ammonium salts during the last fifteen years has not been inferior to that yielded by the nitrate.

In other Rothamsted experiments sulphate of sodium has been used for a long series of years with ammonium salts and superphosphate both on wheat and grass plots to which no potash has been for a long time applied. The crops in these cases remain so good that it is difficult to believe that the sodium salt does not distinctly contribute to the result; an exact basis for calculation is, however, unfortunately lacking. In all the cases quoted the soda will act by displacing potash in the soil, and rendering it more available to the plant, but the general action of soda as an alkali in the laboratory of the plant is not excluded.

We thus conclude that on soils deficient in potash the soda of the nitrate of sodium plays a not unimportant part in the return given by this manure. When potash is thus deficient, the addition of sulphate or chloride of sodium to sulphate of ammonium will increase the yield obtained from the latter salt; but Wagner's experiments do not indicate that the addition of a sodium salt to sulphate of ammonium will enable it to fully equal the return from nitrate of sodium. Abundant illustrations will be supplied presently (p. 329) of the influence of potash and superphosphate upon the relative productiveness of nitrate of sodium and ammonium salts.

#### INFLUENCE OF WEATHER.

No fact is more evident when comparing the actual effects of ammonium salts and nitrate of sodium in the field than that their relative productiveness depends very much on the character of the season in which they are employed. In one season the nitrate may give distinctly the better results, and in

another the ammonia. This effect of season is of a far-reaching character. It is obvious that the times of sowing the manures, of putting in the crop, and of harvest, may considerably affect the result; for the time of year when the use of the manure commences, and the time of year when harvest occurs, clearly determine what part of the season shall affect the result. A wheat field top-dressed with sulphate of ammonium and nitrate of sodium in March or April, and with a harvest in the first week of August, may experience a very different season from a mangel field manured in May and with the harvest in November, although both crops may be grown in the same year. Different soils are also differently affected by the same season; one of the most distinctive, and alas! little studied properties of soil, being their different capacities for retaining water. We have thus a highly complicated problem before us when we seek to understand the undoubted influence of season on the relative value of nitrate of sodium and sulphate of ammonium.

The published reports of the Rothamsted and Woburn experiments afford abundant examples of the crops yielded by nitrate of sodium and ammonium salts, with varying additions of other manures, during a long series of years; unfortunately, however, the data required for elucidating the character of each season are very incomplete. The Rothamsted publications supply us with the monthly rainfall at Rothamsted during the whole course of the experiments. The records of temperature and sunshine, though made for a number of years, have, however, not been published. At intervals of about 20 years detailed reports of some of the field experiments have been issued, and in these the general character of each season is briefly described. In the case of Woburn, we have records of the monthly rainfall during sixteen years, 1882-97. This is all the information at our disposal.

It is most desirable that every Experiment Station carrying on investigations with crops and manures should record and publish full accounts of the character of each season, and of the dates at which each stage in the history of the experiment was reached. Monthly averages of temperature, and monthly rainfalls are quite insufficient; an excess of rain or temperature at the beginning or end of a month may easily give an apparent character to a month which it did not really possess. Weekly averages of temperature, and weekly rainfalls, during the whole period from the application of the manures, or sowing the crop, till harvest, with monthly statements for the rest of the year, would answer very well.

We also need to be acquainted with the power of retaining and supplying water possessed by each experimental soil. For this purpose determinations are required of the quantity of water held by the soil when drainage has ceased after heavy rain, and also of the quantity present when the soil is in a condition of agricultural drought, the difference between the two quantities representing the effective water-retaining capacity of the soil. Many of the differences in the action of manures on different soils are simply due to the differences in the effective supply of water in the soils in question, differences which may easily occur even with an identical rainfall in each case.

The statement is usually made that nitrate of sodium gives a better result than sulphate of ammonium in a dry season, while in a wet season the reverse may be the case. The explanation offered is that nitrate of sodium is washed out of the soil in a wet season, while the ammonium salts suffer from rain to a less extent. This explanation clearly deals with only one half of the assumed facts, it does not account for the superiority of the nitrate of sodium in a dry season.

When we begin to study the results actually obtained at Rothamsted and Woburn in various years, our confidence in any very simple explanation of the difference in effect shown by the two manures becomes very much shaken. While certain broad facts remain, the apparent inconsistencies are very numerous. A season distinctly favourable to nitrate at Woburn frequently displays a different character at Rothamsted; while at both stations different crops, though grown on the same farm, and in the same season, may yield opposite results with the manures in question.

Perhaps the most striking instance of the influence of obscure causes on the action of the manures is afforded by the results given by the wheat and barley crops at Woburn in the year 1882. These experimental crops are grown side by side in the same field, and have received for many years precisely the same manures. In each experiment the effect of nitrate of sodium and ammonium salts is compared on three pairs of plots. Both salts are applied as top-dressings on the same date, the application to the barley coming sometimes a little later than that to the wheat. Notwithstanding this similarity in the conditions of the wheat and barley experiments, the wheat crop in 1882 showed an excess by ammonium salts over nitrate of sodium amounting to 6.0, 2.3, and 7.7 bushels in the three comparative experiments; while, on the contrary, the barley showed an excess by nitrate of sodium over ammonium salts amounting to 5.0, 2.9, and 14.1 bushels in the exactly corresponding trials. Both results

exhibit a considerable departure from the mean relative effect of the two manures, but the departure from the mean took an opposite direction in the case of barley to that of wheat. It is obvious that no explanation can be attempted of cases such as this without a very thorough and detailed knowledge of the successive stages of development of each crop, and of the variations in the season which accompanied them.

**Influence of Rainfall at Rothamsted.**—We proceed now to see what light can be thrown on the subject by studying the relation between the distribution of rain during the growing period and the final produce obtained from the manures at harvest. To study this relation we turn first to the Rothamsted experiments. As already mentioned only monthly rainfalls are available for the present discussion, but by dealing with the average of many seasons instead of looking at individual years the opportunity for error will be much diminished.

1. *The Barley Experiments.*—The conditions of the experiments on the continuous growth of barley in Hoos field are well suited for our present discussion. The ammonium salts and the nitrate of sodium are both spread on the land at the *same time*, at the end of February or beginning of March, and are then ploughed in; both manures thus experience exactly the same weather. The quantities of ammonium salts (200 lb. per acre of mixed sulphate and chloride) and of nitrate of sodium (275 lb. per acre) are also smaller than those generally employed at Rothamsted, and more nearly correspond with ordinary agricultural practice. The quantities of manures employed supply nearly the same amount of nitrogen. There are available for discussion the harvests of thirty years, 1868–97.

Confining our attention to the produce of those plots on which there is the least deficiency of ash constituents, we find that there are thirteen years in which the ammonium salts gave an equal or greater produce of barley grain than the nitrate of sodium, and ten years in which, under similar conditions of manuring, the nitrate clearly surpassed the ammonium salts. If we now calculate from the published Rothamsted records of rainfall the *mean* monthly rainfall for these two groups of years, we obtain the following figures:—

*Mean Rainfall in 13 Seasons in which the Produce of Barley by Ammonium Salts was equal to or greater than that by Nitrate of Sodium.*

March	April	May	June	July
in. 1·81	in. 2·23	in. 2·25	in. 2·39	in. 2·64

*Mean Rainfall in 10 Seasons of distinctly greater Produce by Nitrate of Sodium.*

March	April	May	June	July
in. 1·62	in. 1·74	in. 1·61	in. 1·88	in. 2·58

*Excess of Rainfall in Seasons favourable to Ammonium Salts.*

0·19	0·49	0·64	0·51	0·06
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The evidence thus brought together apparently shows that the ammonium salts have equalled the nitrate of sodium for the production of barley when there has been a rather excessive rainfall in April and May and a full rainfall in June and July, the ample supply of rain thus extending throughout the whole period of active growth of the crop. In the individual years which go to make up this mean result it is, however, by no means always found that the period of ample rain extends over three or four months, it may be confined, possibly, though seldom, to one month of the growing period. The fact which seems to characterise the years favourable to ammonia is that during some considerable portion of the growing period the soil was amply supplied with water.

The seasons in which nitrate of sodium gives a better return than ammonium salts are, on the other hand, seasons of deficient rain, the average deficiency during April, May, and June, as compared with the seasons favourable to ammonium salts, amounting to about half an inch in each month. Here, again, we must not assume that the lack of rain extends in every case over the whole growing period—it is merely the general characteristic of these seasons to be dry.

Although the general character of the seasons which favour the superiority of one or other manure is probably truly shown by the mean rainfalls just quoted, we cannot by merely looking at a series of monthly rainfalls certainly determine whether a particular season was one favourable to ammonium salts or nitrate of sodium. To determine the character of the season from the rainfall much more information would be required. Not only should we need to know the distribution of the rain in more detail, we must also be acquainted with the prevailing temperature, and with the duration of bright sunshine. In cool, cloudy weather, a moderate rainfall may suffice to keep the soil moist; while in a hot season, with brilliant sunshine, even heavy showers will be soon exhausted.

The distribution of the rain which we have seen actually characterises the seasons specially favourable to ammonia or nitrate is not what we should have predicted from the explanation generally given of the cause of the different effects of these manures. If the effect of nitrate of sodium usually fell below that of ammonium salts from the washing-out of the former manure by heavy rain, we should expect to find, in the case of the barley experiments, that a wet March and April was the most potent cause of injury to the nitrate. That very heavy rain in these months is injurious we need not doubt; but the mean rainfalls just quoted show in an unmistakable manner that the wet or dry character of the season, which favours one or other manure, extends quite to the end of the growing period. Now drainage through the soil will very rarely occur during the summer months on land covered by a growing crop. Moreover, after May, the drainage waters from cropped fields (for example Broadbalk field, Rothamsted,) cease to contain nitrates, if no excessive amount of nitrogenous manure has been applied. We cannot therefore suppose that the moderate excess of rain which favours the land manured with ammonium salts acts simply by washing unused nitrate of sodium out of the plot serving for comparison; we must assume that the ammonia plots stand *more in need of rain* than those receiving nitrate if they are to yield an equal result. This is doubtless the correct view to take of the facts before us. Without pretending to give a complete explanation of this complex problem, we can perhaps indicate some reasons why a greater amount of rain is required for the same crop production when ammonium salts are employed instead of nitrate of sodium.

The nitrate of calcium formed from the ammonium salts being produced some time after the application of the nitrate of sodium, and the nitrate of calcium being a less diffusible salt than the nitrate of sodium, more rain and a later rain is needed to distribute the nitrates of the ammonium salts in the soil than is required when nitrate of sodium is employed. This difference in requirement will affect chiefly the earlier part of the season.

We have also seen (p. 304) that the nitrification of the nitrogenous organic matter of the soil will be delayed by the addition of ammonium salts. It thus becomes necessary to provide conditions favourable to the production of ammonia in the soil, and its subsequent nitrification, far into the growing period, if land manured with an ammonium salt is to produce the same result as land to which an equal quantity of nitrogen has been applied as nitrate of sodium. The size of a crop is indeed not determined solely by the manures applied, but by

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wet seasons needed for ammonium salts to yield their  
returns. The two groups of seasons just considered in-  
any of very inferior productive power, the right of any  
a place in one of the groups depending solely on the pre-  
ting effect of one of the two manures which it exhibited.  
gain review the thirty crops of barley in Hoos field,  
k out the seasons yielding the heaviest produce by  
um salts and nitrate of sodium respectively, we find  
two lists include for the most part the same years. In  
ong the seven years of heaviest produce by nitrate of  
and the seven years of heaviest produce by ammonium  
ere are five years, 1869, 1880, 1882, 1883, 1892, which  
to each group. The mean monthly rainfall in these  
ons of excessive productiveness was as follows:—

*rainfall in 5 Seasons of Maximum Productiveness for Barley  
receiving Ammonium Salts or Nitrate of Sodium.*

	March	April	May	June	July
	in. 1·26	in. 2·10	in. 1·87	in. 2·35	in. 3·11

have here neither characteristically dry nor wet seasons.  
wet February, storing the soil with water, we have a

dry March, an April with a rainfall rather above the average, a May with a somewhat scanty rainfall, a full rainfall in June and one rather above the average in July. We have here a marked excess of rain, but the rain is distributed so as to excellently meet the successive requirements of the soil for the crop.

The great characteristic of a season of maximum production is that it is a period of prolonged and uninterrupted growth. A mild spring, favouring early root development, followed by a rather cool but not unfavourable summer, and a rather early harvest, are the conditions which ensure a very heavy production of the cereal crops. These conditions are equally needed whatever may be the nature of the manure applied.

Thus while a wet season tends to give a preponderant effect to ammonium salts, and a dry season a preponderant effect to nitrate of sodium, both manures require a season of much the same character if they are to yield a maximum produce.

2. *The Wheat Experiments.*—Little opportunity is afforded by the experimental crops in the Rothamsted wheatfields for comparing the character of the seasons especially favourable to ammonium salts and nitrate of sodium. This is due to the varying times at which the ammonium salts have been applied. Previously to 1873 the ammonium salts were all applied in the autumn, and the nitrate in the spring. From 1873 to 1883 both manures were applied as top-dressings in the spring. Since this time 100 lb. of the ammonium salts have been applied in the autumn, and the rest (generally 300 lb.) in the spring. The eleven seasons, 1873–83, are thus the only ones available for the present discussion. In this period there are only two seasons in which the ammonium salts with ash constituents on Plot 7 produced a crop equal to or greater than that yielded by the nitrate of sodium with ash constituents on Plot 9a. The mean rainfall in these two seasons shows a considerable excess of rain in April, June and July, but less than an average in May. As far, therefore, as these few seasons go, they agree with the general rule that wet seasons favour the superiority of ammonium salts as a manure for cereal crops.

3. *The Grass Experiments.*—We turn next to the influence of weather on the hay crops manured with ammonium salts and nitrate of sodium in Rothamsted Park. The ammonium salts and the nitrate of sodium have here been applied at the rates respectively of 400 lb. and 550 lb. per acre; the quantities supply nearly the same amount of nitrogen.

manures are applied to the grass as a top-dressing towards the end of February, or in March, the ammonium salts being applied a little earlier than the nitrate. We shall confine our attention to the two plots, 9 and 14, which receive, beside the salts in question, a full supply of alkalies and phosphates. The crops of 40 years, 1858-1897, are available for this discussion.

Looking in the first place at the comparative effects of nitrate of sodium and ammonium salts on the first or main crop of hay, we find nine seasons in which the ammonium salts give an equal or larger produce of hay than the nitrate of sodium, and sixteen seasons in which the nitrate of sodium has a decided advantage. The mean rainfalls of these two groups of years are as follows:—

*Mean Rainfall in 9 Seasons in which the Produce of Hay by Ammonium Salts was equal to or greater than that by Nitrate of Sodium.*

March	April	May	June
In. 2·02	In. 2·51	In. 3·12	In. 3·24

*Mean Rainfall in 16 Seasons of distinctly greater Produce by Nitrate of Sodium.*

1·83	1·62	1·68	2·08
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*Excess of Rainfall in Seasons favourable to Ammonium Salts.*

0·19	0·89	1·44	1·16
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We have here the same kind of difference in the two groups of seasons which we observed in the case of the barley experiments, but in the case of the hay crop the difference is far more strongly marked. The ammonium salts have indeed proved equal to or better than the nitrate only in very wet seasons, the excess of rainfall in seasons especially favourable to ammonium salts amounting to about  $3\frac{1}{2}$  inches during the three months forming the growing period.

In this case, as previously remarked in the case of barley, the excess of rain in the seasons favourable to ammonium salts is distributed through the whole growing period, and any explanation of the relation between weather and manure must deal with this fact.

The grass experiments supply striking evidence of the more

prolonged growth which takes place when ammonium salts used as manure. During the last twenty years a second crop of hay has been cut in September or October, and its weight recorded. Although the first crop most generally shows greater produce by nitrate of sodium, the second crop almost as usually shows a greater produce by ammonium salts. the production of this characteristic subsequent growth on ammonia plots a sufficient summer rainfall is naturally required.

When we study the character of the rainfall occurring during the seasons of greatest produce, we do not find, as in the case of barley, that nearly the same character of season suffices to produce maximum crops of hay whether the manuring is with ammonium salts or nitrate of sodium. There are, in the forty years of the grass experiments, four first crops of hay of over three tons produced by a manuring of ammonium salts and ash constituted on Plot 9, and nine similar crops of hay produced by nitrate of sodium and ash constituents on Plot 14. In the nine last-named seasons only two of the first group occur. The mean rainfall during the two groups of seasons were as follows :—

*Mean Rainfall of 4 Seasons, in which 400 lb. of Ammonium Salts produced over three tons of Hay.*

March	April	May	June
in. 1·26	in. 2·86	in. 2·83	in. 2·88

*Mean Rainfall of 9 Seasons, in which 550 lb. of Nitrate of Sodium produced over three tons of Hay.*

1·84	2·43	1·82	2·16
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We have here again before us the now familiar fact that ammonium salts require a much wetter growing season to produce a full crop of hay than is the case with nitrate of sodium.

The grass experiments thus supply the most striking example of the need of a considerable summer rainfall for the full success of ammoniacal manures. What has been already said as to the causes of the slower development of crops receiving ammonium salts, as compared with those receiving nitrate of sodium, and the need of maintaining a moist condition of the soil if the crops manured with ammonia are to reach their greatest development, applies indeed with special force to the case of meadow land. The nitrification of ammonium salts applied as a top-dressing to old grass land will prob-

dedly slower than in the case of an arable soil; the relation of humus which characterises grass land tends to deprive the soil of the basic matter needed for nitrification, while some of the recent residues of vegetable matter will probably have a retarding influence on nitrification in a manner lately pointed out by Winogradsky. It is also in low land, with its accumulations of nitrogenous organic matter that we should expect to find the largest amount of organic matter, with the production of ammonia during the summer months, and this utilisation of soil ammonia is, we have seen, retarded by the addition of ammonium salts. There are thus several probable causes, all of which tend to make the production of nitrates especially poor when meadow land is manured with ammonium salts. The production of ammonia and nitrates in the soil is of course only possible when the soil continues moist during the summer months.

We have yet to notice the part played by the character of the herbage. The surprisingly large crop of hay produced by the use of sodium in the very dry season of 1870 was made the subject of a special study at Rothamsted. It appeared from an examination of the soil that the crop had succeeded in taking more water from the subsoil than the crop manured with ammonium salts. The results of the grass experiments at Rothamsted are much complicated by the fact that a very different grass is now growing on the various plots, a consequence of the long-continued action of the different manures. Lawes and Gilbert were of opinion that a chief cause of the successful nitrification of subsoil water on the nitrate plot was the presence of a plant on this plot of *Bromus mollis*, a deep-rooted grass which formed about one-half of the whole hay crop, and the roots of which were traced to 4 ft. below the surface. It was deduced from this investigation that a further cause of the need for summer rainfall on the ammonia plots at Rothamsted was the shorter root range of the herbage. This cause of difference between ammonium salts and nitrate of sodium can only be expected to arise except in cases where the use of the former has been long continued.

*The Potato Experiments.*—In the potato experiments at Rothamsted the ammonium salts and the nitrate of sodium are applied to the land at the same time in March or April, and are thoroughly incorporated with the soil before the potatoes are sown. The same quantities of these salts are used as in the grass experiments. The potatoes grown are of the main crop

variety, so that the growing period extends through the whole the summer and early autumn.

A classification of the seasons in two groups, according to the greater productiveness of the ammonium salts or nitrate of sodium, does not reveal any considerable difference in the mean rainfall during the whole growing period. The average total rainfall from April to September in nine seasons in which the ammonium salts gave a distinctly better result was 15.2 inches and in eight seasons in which the nitrate of sodium was decidedly superior 14.7 inches. The only distinct appearance of great dryness in the nitrate seasons occurs in May and June, the mean total rainfall for these months being one inch less than in the seasons favouring ammonia.

With the thorough incorporation of the ammonium salts with the soil in these experiments, and the very prolonged period available for nitrification, we should not expect to find that the supply of nitrates on the ammonia plots was deficient. Even through lack of rainfall in any ordinary season, the want of rain in one month being generally made up by a full supply in other months. Nor on the nitrate of sodium plot can the crop derive any especial advantage from the production of earlier and deeper roots, enabling it to draw more water from the subsoil, as the roots of the potato are always confined to the surface soil. We can thus see reasons why variations in rainfall have comparatively but little effect in determining the greater productiveness of ammonium salts or nitrate of sodium when these are applied to potatoes in the manner employed at Rothamsted. Unfortunately the records of rain are the only data available for a study of the characters of the seasons in question.

5. *The Mangel Experiments.*—The ammonium salts and the nitrate of sodium have both been applied to the land at the same time, and thoroughly mixed with the soil before sowing the mangel seed. The manures have been usually applied in April. A much smaller series of crops is available for study in the case of mangels than in the case of the other crops already mentioned. All seasons in which there has been a failure of the plant have been excluded from notice.

As in the case of potatoes, no distinct difference is perceived in the total rainfall of the growing period, whether the season favoured ammonium salts or nitrate of sodium, but the fact does not carry very much weight owing to the few seasons contributing to the mean. In three seasons, in which the crop by ammonium salts and ash constituents (Plots 4A and 6A) equalled, or nearly equalled, the corresponding crops by nitrate of sodium (Plots 4N and 6N), the mean total rainfall from May to September

5 inches; while in four seasons, in which the nitrate considerably larger crop, the mean total rainfall for the period was again 12·6 inches. As, however, in the case of potatoes, so now, the summer months are drier in the nitrate than the ammonia series, the mean difference in June is showing an excess of rain amounting to 1·37 inch in seasons favourable to ammonium salts.

remarks already made as to the favourable conditions complete nitrification presented by potato culture apply to the case of mangels. The mangel, however, possesses characteristically deep root, and if nitrate of sodium has the effect of securing an earlier and deeper extension of the roots, we should expect the nitrate to yield the better result in dry

**Deficiency of Rainfall at Woburn.**—The average rainfall at Woburn is much smaller than at Rothamsted. During the years, 1882–97, the average rainfall at Woburn has been 12·6 inches, which is about 5 inches less than the rainfall for the same period at Rothamsted. The very moderate rainfall at Woburn is nevertheless sufficient to produce heavy crops, a result largely due to the character of the soil; the water held by a fine sand is indeed far more readily available than the water of a crop than the water contained in a heavy clay.

At Woburn the ammonium salts and nitrate of sodium were applied as top-dressings to the wheat and barley crops, in the month of May. The application thus falls much earlier in the season than at Rothamsted. With this late application of the ammonium salts at Woburn, coupled with the addition of lime to the soil, the process of nitrification is prolonged far into the season, and in some cases a considerable residue of nitrates remains unused in the soil in autumn, which strikingly affects the crop in the following year, as is shown by the results on Plots 8a and 8b, which receive ammonium salts in alternate years, one of the plots thus showing in every season the effect produced by the residue of nitrates from previous manuring.

**The Wheat Experiments.**—Looking first at the crops on Plots 1 and 6, which receive ammonium salts and nitrate of sodium in equal proportions, giving nitrogen equal to 50 lb. of ammonia per acre, with complete cinereal manure, we find that in seven years out of sixteen for which records of rainfall are available the yield from the ammonium salts was distinctly better than that from the nitrate of sodium; while in other seven years the reverse was the case. The mean rainfalls during the growing periods of

these two groups of seasons do not show that the seasons were generally wetter in the years of greater produce by ammonium; the average fall of rain in the two groups of seasons is indeed nearly the same in each case.

If, however, we construct our groups by selecting the years of greatest produce by each manure, irrespective of any excellence of one over the other, we obtain a somewhat different result. There are five years in which the ammonium salt yielded over 35 bushels per acre, and six years in which the nitrate did the same; the second group includes three years belonging to the first. The average rainfall for various periods in these two groups of seasons was as follows :—

					Nitrate crop, over 35 bushels	Ammonia crop, over 35 bushels
					in. rain	in. rain
May to July	.	.	.	.	5·89	6·45
May to August	.	.	.	.	7·97	8·38
April to August	.	.	.	.	9·54	10·59

Thus by confining our attention to the big crops, the large requirement of rain by the ammoniacal manure becomes perceptible.

When we turn to Plots 8 and 9, receiving twice the amount of ammonium salts and nitrate that is applied to Plots 5 and 6, the influence of more or less rain becomes distinctly marked. This is as we should expect. Plot 8, receiving the large dressing of ammonia, needs for success, even more than Plot 9, a long-continued state of moisture in the soil, both for the nitrification of the ammonia, and for the utilisation later in the season of the organic nitrogen of the soil, which utilisation the ammonium salt had at first hindered. Plot 9 is, on the other hand, so well supplied with ready-formed nitrate, that so far as the supply of plant food is concerned, it is more independent of rain than Plot 6.

If we compare the average rainfall in four seasons in which the nitrate beat the ammonia, with the amount of rain in six seasons in which the ammonia decidedly beat the nitrate, we find that in the group of seasons favourable to the nitrate the average rainfall from April to August has been 7·72 inches, while in the seasons favourable to the ammonia it has been 10·59 inches. If we choose to regard only the seasons yielding the best crops, we can compare the average rainfall in seven seasons in which the ammonium salts gave over 40 bushels with the rainfall in five seasons in which the nitrate gave

produce; three years in the first series occur also in the  
The average amounts of rain in these groups of  
were as follows:—

	Nitrate crop, over 40 bushels in. rain	Ammonia crop, over 40 bushels in. rain
May to July . . . . .	5.32	6.62
May to August . . . . .	6.72	8.74
April to August . . . . .	8.21	10.73

either way of viewing the results there is thus plain  
that the seasons especially favourable to the ammonium  
the wetter seasons, and that the extra supply of rain  
cases extends throughout the whole growing period.

*The Barley Experiments.*—There are in this case only  
years available for discussion, as the later barley crops  
with ammonium salts suffered so much from the  
of the lime in the soil that they cannot fairly be  
with the crops produced by nitrate of sodium in the  
years.

In the case of the Plots 5 and 6, receiving the smaller dress-  
ure is only one year in which the ammonium salts beat the  
but we may include in the seasons favourable to am-  
our other seasons in which the ammonium salts nearly  
the nitrate. The average rainfall during these seasons  
as follows with the rainfall of five seasons in which  
ate decidedly beat the ammonium salts:—

*Rainfall in 5 Seasons in which the Produce of Barley by  
Ammonium Salts on Plot 5 nearly equalled that given by Nitrate  
of Sodium on Plot 6.*

	May	June	July	August
	in. 2.29	in. 1.79	in. 2.62	in. 1.85

*in Rainfall in 5 Seasons of distinctly greater Produce by  
Nitrate of Sodium.*

	1.67	1.97	2.16	1.56
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In the case of Plots 8 and 9, receiving the heavier  
of manure, there are four years in which the am-  
salts yield a better result than the nitrate, and also four  
in which the nitrate excels the ammonium salts. The average  
of these two groups of seasons were as follows:—

*Mean Rainfall in 4 Seasons in which the Produce of Barley & Ammonium Salts on Plot 8 was greater than that by Nitrate of Sodium on Plot 9.*

April	May	June	July	August
in. 1·91	in. 1·91	in. 1·95	in. 3·36	in. 1·43

*Mean Rainfall in 4 Seasons of distinctly greater Produce by Nitrate of Sodium.*

2·20	2·37	1·75	1·42	1·60
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We have here an average total rainfall between April and August of 9·34 inches in the seasons favourable to nitrate and of 10·56 inches in the seasons favourable to ammonium salts. It is instructive to remark that the excess of rain which apparently favours the action of the ammoniacal manure occurs in July and June, and that the years favourable to the nitrate of sodium show a distinctly greater rainfall in May, the month of the application of the nitrate, and when most washing would be expected. This is quite in accordance with what we have already urged—it is apparently the *summer rainfall* which has most influence in determining the greater productivity of the ammonium salts.

In closing this section, we must confess that much still remains to be done to elucidate the causes of the very considerable variations in the relative productiveness of the manures brought about by the influence of weather.

#### INFLUENCE OF TIME OF APPLICATION.

The time of application has a considerable influence on the effect of every manure, and especially is this the case when the manure consists of soluble salts, as in the instance before us.

The fact that soil possesses no retentive powers for nitrate of sodium, and that it is therefore liable to be washed into the subsoil by heavy rain, has naturally led farmers to apply the manure to their crops at as late a period as possible. There is undoubtedly no manure so suitable as nitrate of sodium for late top-dressing, as in the speed with which it is capable of distributing itself in the soil it excels every other manure, save common salt (chloride of sodium). Practical limits to the lateness of the application are fixed by the weather, for even nitrate of sodium will not diffuse in a dry soil, and also by the stage of growth reached by the crop. Cereal crops, for

cease to increase their store of nitrogen soon after sowing. Late dressings should always be very small, as the effect of a late application of nitrate is to produce straw rather than corn, and leaf rather than root.

Ammonium salts cannot be successfully applied as a top-dressing at so late a period as nitrate of sodium, as time is required for the nitrification of the ammonia, and the nitrate formed is not itself so diffusible a salt as nitrate of soda. Nevertheless, with small dressings, applied in a wet state to arable soils in good tilth, and sufficiently provided with phosphate of calcium, there will be no great difference in the effect of the action of the two manures.

Although both manures may occasionally be applied to the crop with advantage as a late dressing, the manure of sodium seldom yields its best return. Late dressings can do little towards the production of root development, and do not secure an abundant root development both the fertility of the soil and the manure applied will remain imperfectly utilised. Late dressings are also apt to furnish an inferior quality of produce. Thus, in the culture of sugar beet, it is imperative that nitrogenous manures should be applied to the land before the growth of the crop commences if the maximum percentage of sugar is to be obtained.

In a climate having no excessive rainfall, and with a soil of high retentive power for water, excellent results are obtained by applying both the ammonium salts and nitrate of sodium to the soil before sowing spring corn, potatoes, or mangel-wurzel. Under these circumstances, the crop finds the nitrates dissolved throughout the surface soil, and standing ready for absorption as soon as its active growth commences. The application of the ammonium salts and nitrate of sodium to the soil at this early period is the plan which has been followed at Rothamsted in the cultivation of the crops just named; it has been attended with very good results, both as to the returns in produce per unit of nitrogen applied, and also as to the relative efficiency of the two manures.

In place of this early spring application, which we may regard as an intermediate method, we may have a still earlier application, or a considerably later use of both manures as top-dressings.

In the Rothamsted wheat field the whole of the ammonium salts were ploughed into the land in autumn before drilling the wheat up to the year 1872. Some of the largest crops grown in the course of the wheat experiments were obtained during this period.

During the next eleven years a comparison was made

of the relative effects of spring and autumn applications of ammonium salts. The plot manured in spring received ammonium salts as a top-dressing in March. These eleven years included many inferior seasons. In three seasons autumn manuring gave the larger return, while in eight seasons the spring dressing proved the more productive. The average excess of crop by the spring over the autumn application amounted to 4 bushels of wheat, and  $5\frac{1}{2}$  cwt. of straw per acre. Since 1883, 100 lb. of the ammonium salts have been applied to the land in the autumn, and the remainder as a top-dressing in the spring.

In the experiments with wheat at Holkham in Norfolk, a comparison of autumn and spring applications of ammonium salts was made during four years. The average results were autumn application, 31.4 bushels; spring application, 31.4 bushels. In this, probably, drier climate, the application in autumn proved quite as effective as that in spring.

In P. De Vuyst's trials of nitrate of sodium and ammonium salts for wheat in Belgium, the application of half the ammonium salts in the autumn, and half in the spring, was found to produce the greatest yield, while the nitrates always did best in the spring.

Maercker, in his field experiments in Saxony, found that sulphate of ammonium produced only about two-thirds as large an increase in the sugar-beet crop as was yielded by an equivalent quantity of nitrate of sodium when both manures were applied in the spring; but when the ammonium salt was applied in the autumn it produced as large a crop as the nitrate.

These examples show very plainly that there are circumstances in which a very early application of the ammonium salts is distinctly advantageous; such cases will specially occur in dry climates, and in soils in which nitrification proceeds very slowly, as, for instance, in those containing a very small quantity of lime.

The tendency of the present day has been undoubtedly to proceed in an opposite direction, and to postpone the application of the manures as long as possible, with the view of avoiding the loss of nitrates by drainage. Dressings of nitrate of sodium have also for the same reason been divided, and portions applied to the crop at different times. Few systematic trials have, however, been made as to the comparative effect of earlier and later dressings.

In 1891 Dr. Aitken<sup>2</sup> tried the effect on the turnip crop of small quantities of nitrate of sodium and sulphate of ammonium

<sup>1</sup> Journal R.A.S.E., 1855.

<sup>2</sup> Trans. High. Soc. 1892.

applied to some plots at the time of sowing the seed, and to others in various fractions at a later period; the experiments were conducted simultaneously on 26 farms. In this season a prolonged drought in June and part of July was followed by a deluge of rain. In 1892<sup>1</sup> a similar experiment was repeated on 42 farms. This season is described as somewhat dry, cold, and backward. In every case the total quantity of nitrate of sodium employed amounted to 120 lb., and of sulphate of ammonium to 86 lb. per acre. The same phosphates were applied to every plot. The mean increase by manure obtained on the various plots in both years is shown in Table I. below:—

TABLE I.—*Results of applying Sulphate of Ammonium and Nitrate of Sodium to the Turnip Crop at various times (Aitken).*

Experiments in 1891.

Times of applying the salts	Increase of roots by	
	Sulphate of ammonium	Nitrate of sodium
At sowing . . . . .	cwts. 32½	cwts. 30
½ at sowing, ½ a week after singling . . . .	29½	33
½ sowing, ½ singling, ½ six weeks later . . .	24	21
½ singling, ½ six weeks, ½ twelve weeks later .	15½	14

Experiments in 1892.

At sowing . . . . .	25	31
Ten days after singling . . . . .	8	7
Six weeks after singling . . . . .	—	6
½ at sowing, ½ six weeks after singling . . .	13	20

It will be observed that in every instance save one, both of the manures produced their best effect when applied at the earliest time.

It appears evident from what has now been said that no general rule can be given as to the best time of applying these manures, save that the application should always be made as early as is consistent with freedom from serious loss by drainage. As young plants may be considerably injured by contact with concentrated solutions of salts, top-dressings should, if possible, always be applied during the fine intervals of showery weather.

#### INFLUENCE OF IMPURITIES

In early days care had to be taken that the ammonium salt purchased from the gas works was free from sulphocyanates,

<sup>1</sup> Trans. High. Soc. 1893.

such salts being poisonous to vegetation. Now that sulphate of ammonium is prepared from distilled ammonia the risk just mentioned has practically ceased.

During the last few years attention has been called to the presence of perchlorates in commercial nitrate of sodium, and particular injury to rye and oats observed in Belgium, Germany and other places, has been attributed to the presence of these salts. There is no doubt that a small quantity of perchlorate of potassium is generally present in commercial nitrate of sodium; it occurs there because it is a natural constituent of the "caliche" from which the nitrate of sodium is extracted. There is no doubt, also, that if applied in sufficient quantities the perchlorate acts very injuriously on cereal crops. On the practical question, whether there is ever enough perchlorate present in nitrate of sodium to produce an injurious result, opinion is divided. Wagner, in twenty samples of nitrate of sodium, found from 0.14 to 1.65 per cent. of potassium perchlorate, the average being 0.75 per cent. Sjollemas states that he has found in two cases 3 per cent., and in one case 6.7 per cent. of perchlorate; no one else seems to have obtained so high a percentage. Wagner believes that when the perchlorate does not exceed the amount shown in his analyses no injurious action need be feared. Maercker, on the other hand, speaks of the injurious results observed on field crops of rye, when the perchlorate reached  $1\frac{1}{2}$  per cent. Steffek, in a series of pot experiments with oats, found a distinct prejudicial action when 1 per cent of perchlorate was present. Photographs of the series of manured plants in his experiments are published in a recent number of the *Landw. Versuchs-Stationen* (Band lii. s. 16). There seems no doubt that dryness of the soil intensifies the action of the perchlorate, and that when wet weather follows the application of the manure, rather considerable quantities of perchlorate have no ill effect. Mangel-wurzel is much less sensitive to perchlorate than oats or rye.

When nitrate of sodium contains 95 per cent. of real nitrate the presence of a prejudicial amount of perchlorate need not be feared, but this assumes that the 95 per cent. has been ascertained by an actual determination of nitric acid, and has not been found by difference, which is a common practice among analysts. Ordinary analysts do not take into account the presence of perchlorates in nitrate of sodium, and when the real nitrate is found by difference the chlorates and perchlorates present are reckoned as nitrate.

## RELATIVE PRODUCTIVENESS.

ng now made ourselves acquainted with a number of  
rs respecting the properties and behaviour of am-  
salts and nitrate of sodium under the various conditions  
use in agriculture, we are now in a position to discuss  
ive productiveness of these manures as shown by actual  
ls with crops.

use of both manures has now extended over more than  
rs, and abundant records are therefore available as to  
s obtained by their application. It is only, however,  
th manures have been systematically employed on the  
l, for the same crops, and in the same seasons, that we  
material for an accurate comparison between them.  
in his prize essay, "Der Chilisalpeter," 1886, quotes  
of field experiments in which the comparative effect of  
um salts and nitrate of sodium on various crops has  
ertained; more than half of these experiments are from  
ts obtained at Rothamsted and Woburn. Unfortunately  
od of stating the results is of no use for our present  
; he merely tells us by how many kilograms the  
of one manure exceeded the produce yielded by an  
nt quantity of the other, a fact which gives no idea of  
ive produce of the two manures. It is also unfortunate,  
alas! no novelty, that few of the German journals and  
o which he refers can be found in an English library.  
d therefore confine our attention mainly to the experi-  
ade and the results obtained in our own country.

ence of **Cinereal Manures**.—One of the first things which  
our attention when comparing the results yielded by  
um salts and nitrate of sodium at Rothamsted is the  
influence which the use or non-use of cinereal  
, and especially of alkali salts, has upon the relative  
veness of these two manures.

he plots at Rothamsted, exhausted of available alkalies  
phates by a long-continued removal of all the produce,  
f sodium applied alone gives frequently a far better  
an ammonium salts applied alone; but if alkalies and  
tes are applied with each, the return from the two  
omes far more equal. This fact does not appear to any  
extent in the experiments with cereal crops, but it is a  
characteristic feature of the results given by grass land,  
and mangel-wurzel.

the old grass land in Rothamsted Park, Plot 15 re-  
50 lb. of nitrate of sodium per acre for eighteen years,

1858-75, while Plot 5 received 400 lb. (an equivalent quantity) of ammonium salts. During these eighteen years the produce of the ammonia plot fell off so much, that at last it became little more than that on the permanently unmanured land, while the nitrate of sodium continued to give a considerable increase. Comparing the average hay crop given by these two manures when applied alone with those given when alkali salts (sulphate of potassium, sodium, and magnesium) and superphosphate of lime were added to each, we have the following figures:—

*Average Produce of Hay in 18 Years, 1858-75.*

No manure	Ammonium salts	Ammonium salts and cinereals	Increase by cinereals	Nitrate of sodium	Nitrate of sodium and cinereals	Increase by cinereals
cwt. 21	cwt. 25½	cwt. 50½	cwt. 25½	cwt. 35½	cwt. 57	cwt. 21½

The nitrate of sodium thus produced 10½ cwt. more hay than the ammonium salts when both were applied alone, but was only 6½ cwt. better when a mixed cinereal manure was added to each. The cinereal manure added 25½ cwt. to the produce by ammonia, and 21½ cwt. to the produce by nitrate.

If we compare the *increase* of hay given by ammonium salts alone, and by ammonium salts with alkalies and superphosphate with the corresponding increase when nitrate of sodium was used, the result appears still more striking. Taking the increase on the nitrate plots in each case as 100, we have the comparative increase by the two manures as under:—

*Relative Increase by Manure—Rothamsted Hay.*

	Ammonia	Nitrate
Ammonium salts and nitrate of sodium applied alone	29	100
"phosphate" . . . . . with alkalies and super-	80	100

In the potato experiments at Rothamsted we have again plots on which ammonium salts and nitrate of sodium have been applied alone for twenty years, 1876-95, and other plots on which the same manures have been used in conjunction with alkalies and superphosphate. The comparative increase in crop yielded by the manures under these two conditions has been as follows, taking as before the increase by nitrate as 100:—

*Relative Increase by Manure—Rothamsted Potatoes.*

	Ammonia	Nitrate
Ammonium salts and nitrate of sodium applied alone	41	100
"phosphate" . . . . . with alkalies and super-	90	100

The yield of the ammonium salts thus approaches nearly to that of the nitrate if all the ash constituents required by the crop are supplied, but falls far below it when they are withheld.

The mangel-wurzel experiments give us a similar result, but in more detail, as in this case we are able to distinguish between the action of the superphosphate and the alkali salts, which together compose the mixed cinereal manure. The average root-crops during seventeen years show the following relative amounts of increase under the various conditions of manuring:—

*Relative Increase by Manure—Rothamsted Mangels.*

	Ammonia	Nitrate
Ammonium salts and nitrate applied alone . . . . .	24	100
" " " with superphosphate . . . . .	32	100
" " " " alkalies and super-phosphate . . . . .	75	100

It is quite evident from these figures that the alkali salts were far more effective than the superphosphate in raising the produce by ammonium salts to nearly the level reached by the nitrate of sodium.

In the case of the cereal crops, the diminished efficiency of ammonium salts, as compared with nitrate of sodium, on land which has suffered a prolonged exhaustion of ash constituents, is much less conspicuous; it is, however, now quite perceptible on the barley plots at Rothamsted. The average produce of barley grain, grown during twenty years, 1872–91, under the special conditions of manuring in question, exhibits relative amounts of increase from the two manures as follows:—

*Relative Increase by Manure—Rothamsted Barley.*

	Ammonia	Nitrate
Ammonium salts and nitrate applied alone . . . . .	79	100
" " " with superphosphate . . . . .	81	100
" " " " alkali salts . . . . .	86	100
" " " " alkalies and super-phosphate . . . . .	94	100

Here, as in the mangel experiments, the greatest effect in increasing the return from the ammonium salts is produced by the manure supplying potash. Comparing these results with the facts already mentioned in a previous section (p. 308), we can have no doubt that nitrate of sodium possesses a power of utilising the natural potash of a soil which is not possessed by ammonium salts, and that this power probably resides in the soda which the former manure supplies.

The facts just noticed are often not perceived when com-

parisons of nitrate of sodium and ammonium salts are made in ordinary field experiments; the smaller power of ammonium salts to utilise the alkalies of the soil is manifested only on poor or exhausted land, or when production is pushed to its furthest limit. In the Woburn experiments with wheat and barley, the relations observed at Rothamsted are curiously reversed, and the ammonium salts give a better return, relatively to the nitrate, when used alone, than when alkalies and superphosphate are added. The relative increase of wheat and barley grain by the two manures is as follows:—

*Relative Increase by Manure—Woburn Wheat (20 years).*

	Ammonia	Nitrate
Ammonium salts and nitrate of sodium alone . . . . .	102	100
" and superphosphate " . . . . . with alkalies	94	100

*Relative Increase by Manure—Woburn Barley (16 years).*

	Ammonia	Nitrate
Ammonium salts and nitrate of sodium alone . . . . .	95	100
" and superphosphate " . . . . . with alkalies	84	100

The explanation of this anomaly is probably supplied by the poverty of the Woburn soil in carbonate of calcium, and the retardation of nitrification which this fact occasions. Not only does the ammonium salt consume lime, the bases in the soil are equally used up by the alkali sulphates and the superphosphate. There is thus a competition for lime on Plot 5, where alkali salts and superphosphate are annually applied, which does not exist on Plot 2, where they are omitted, and the nitrification of the ammonia will proceed more speedily where the ammonium salt is applied alone.

In the case of Wright's numerous experiments on oats, grown after lea in an ordinary Scotch rotation, we have the same relations as at Woburn. The ammonium salt gives, relatively to the nitrate, its best return when applied alone; the relative return is diminished by the addition of superphosphate, and still more by the further addition of sulphate of potassium. In the following figures the relative return in oat grain by ammonium salt and nitrate of sodium employed alone is calculated from three years' experiments on forty-two farms; the relation when superphosphate was added, from four years' experiments on 51 farms; the relation when an alkali-salt was also used, from four years' experiments on 53 farms:—

*Relative Increase by Manure—Scotch Oats.*

	Ammonia	Nitrate
Ammonium salts and nitrate of sodium alone . . .	132	100
"      "      "      "      with superphosphate . . .	111	100
Ammonium salts and nitrate of sodium with alkalies and superphosphate . . .	109	100

Its such as these are unusual, and the facts necessary explanation are not apparent.

**Runs with a full Cinereal Supply.**—It is obvious, from the mentioned, that if we are to form a trustworthy estimate the relative productiveness of ammonium salts and of sodium, we must regard only those experiments in which both manures were associated with a full supply of ash elements. It has also been made abundantly evident that the crops obtained in a single season can carry but little owing to the considerable influence which the weather has on the result. In Table II. (p. 334) will be found the average of trials on various crops, made with a full supply of ash elements to the soil, and which have in most cases been continued throughout many years.

To ascertain the relative productiveness of ammonium and nitrate of sodium with accuracy, we must of course use such weights of these salts as will supply the crop with equal quantities of nitrogen. A difficulty on this point was the case of the Rothamsted experiments. When these continued experiments commenced, the 400 lb. of ammonium salts (equal parts sulphate and chloride) were estimated to contain 100 lb. of ammonia, and the 550 lb. of nitrate of sodium to supply an equivalent quantity of nitrogen. The weights of the ammonium salts and nitrate of sodium have remained unaltered during the whole course of the experiments, and the quality of these manures has changed. The 400 lb. of ammonium salts now supply about 111 lb. of ammonia, and the 550 lb. of nitrate of sodium supply nitrogen equal to about 100 lb. of ammonia. In calculating the relative productiveness of the nitrate and ammonium salts, I have attempted to make a correction for this error, on the assumption that the composition of the salts has progressed in a regular manner during the whole period of the experiments. The correction to be made is very small till we approach the later years of the experiments, when the excess of ammonium salts in the manure finally becomes about 6 per cent.

**Cinereal Crops.**—Looking now at the results relating to crops brought together in Table II., we observe that the

TABLE II.—Average Increase of Produce yielded by Ammonium Salts, in Soils well supplied with Cinereal Manures, for yielded by Nitrate of Sodium supplying the same quantity Nitrogen.

	Corn	Str
<b>WHEAT</b>		
Rothamsted, 400 lb. ammonium salts, top-dressed March, 11 years, 1873-83	74	6
Rothamsted, 400 lb. ammonium salts, $\frac{1}{2}$ autumn, $\frac{1}{2}$ March, 13 years, 1885-97	88	7
Woburn, 183 lb. ammonium salts, top-dressed May, 20 years, 1877-96	94	8
Woburn, 366 lb. ammonium salts, top-dressed May, 20 years, 1877-96	117	9
<b>BARLEY</b>		
Rothamsted, 200 lb. ammonium salts, ploughed in, March, 20 years, 1872-91	93	8
Woburn, 183 lb. ammonium salts, top-dressed May, 16 years, 1877-92	84	7
Woburn, 366 lb. ammonium salts, top dressed May, 16 years, 1877-92	92	8
Cirencester, 175 lb. sulphate of ammonium, top dressed May, 6 years, 1885-90	92	7
<b>OATS</b>		
Rothamsted, 400 lb. ammonium salts, ploughed in, March, 5 years, 1869-73	102	15
Cirencester, 175 lb. sulphate of ammonium, top-dressed May, 2 years, 1894-95	91	6
Scotch, 85 lb. sulphate of ammonium, harrowed in, April, 4 years, 1894-97	109	9
<b>MEADOW HAY (first cutting only)</b>		
Rothamsted, 400 lb. ammonium salts, top-dressed February, 18 years, 1858-75	80	
Cirencester, 224 lb. sulphate of ammonium, top-dressed, 9 years, 1889-92, 1894-98	94	
Pumpherston, 156 lb. sulphate of ammonium, top-dressed, 5 years	80	
<b>MEADOW HAY (first and second cuttings)</b>		
Rothamsted, 400 lb. ammonium salts, top-dressed February, 20 years, 1876-95	88	
<b>POTATOES</b>		
Rothamsted, 400 lb. ammonium salts, ploughed in, March, 10 years, 1876-85	101	
Rothamsted, 400 lb. ammonium salts, ploughed in, March, 20 years, 1876-95	90	
<b>SUGAR BEET</b>		
Rothamsted, 400 lb. ammonium salts, ploughed in, April, 3 years, 1871-3	68	
<b>MANGEL-WURZEL</b>		
Rothamsted, 400 lb. ammonium salts, ploughed in, April, 17 years, 1876-84, 1886, 1888-94	76	7
Rothamsted, 400 lb. ammonium salts, with 14 tons dung, 16 years, 1876-84, 1886, 1889-94	79	15
	<b>Hay</b>	
	<b>Tubers</b>	
	<b>Roots</b>	<b>Leaves</b>

return given by the ammonium salts is in a large majority of cases below that given by the nitrate of sodium, and that the deficiency of produce is less in the corn than in the straw. Thus for 100 parts of increased produce of corn or straw by nitrate of sodium there is, in the case of four series of experiments with wheat, an average increase by ammonium salts of 93 corn and 80 straw; and in the case of four series of experiments with barley, an average of 90 corn and 78 straw. The three series of experiments with oats show an average return of 101 in corn, and 94 in straw, by the ammonium salts, for a return of 100 by nitrate of sodium. An abnormal return of oat-straw occurs in the Rothamsted oat experiments where alkali salts and superphosphate are applied, it scarcely appears where the ammonium salts and nitrate of sodium are applied alone. Omitting the Rothamsted results with oats, the mean of 10 series of experiments with cereal crops shows that the yield of corn by ammonium salts is 93 per cent., and of straw 79 per cent. of that given by an equivalent quantity of nitrate of sodium.

The decided excess of straw yielded by nitrate of sodium in farm practice demands some remark. The fact is probably connected with the supply of soda to the plant, the straw being the part of the crop characteristically rich in alkali. It must be always recollected that nitrate of sodium supplies alkali to the plant in a far more available form than is supplied by the chloride or sulphate of sodium. The nitrate is decomposed in the plant and the nitric acid consumed for the production of organic matter; the soda is thus left as an available base for combination with the organic acids of the plant. The same cannot be said of the alkali salts having fixed acids. It is curious that in Wagner's pot-and-bed experiments this usual excess of straw by nitrate of sodium does not appear.

The relative productiveness of ammonium salts and nitrate of sodium is plainly affected by the quantity of the salts applied. In Table II. we find two pairs of experiments, in which wheat or barley were grown in the same seasons, and in the same fields, with single and double quantities of each manure; in each case the productiveness of the ammonium salt is considerably increased in comparison with the nitrate, when the larger quantity of ammonia is applied. The same fact commonly appears in Wagner's comparison of the effect of these salts in his pot-and-bed experiments. It is easy to see that when a weaker and stronger manure are both used in *excess* of the requirements of the crop they may then appear to be of equal value, as in both cases the crop receives as much as

it can possibly use. This obvious truth doubtless supplies part of the explanation of the fact in question. The approach to an equalisation of the results through the presence of an excess of plant food may, of course, occur with small dressings of ammonium salts and nitrate if both are applied to land already in good condition, or receiving farmyard manure; and this may be the explanation of the high relative value of ammonium salts shown in some farm experiments. The presence of an excess of plant food in the soil cannot, however, explain a greater return given by ammonium salts than nitrate, as shown, for instance, in the Woburn trials with double dressings upon wheat. To bring about such a result there must be some decided advantage on the side of the ammonium salts, or a disadvantage on the side of the nitrate.

In nineteen experiments with wheat made on German farms in four years, and reported by Maercker, sulphate of ammonium yielded on an average 86 per cent. of the crop produced by nitrate of sodium, both in corn and straw. In experiments on nine farms with barley the return by sulphate of ammonium in corn was 80 per cent. of that given by the nitrate, and in straw 50 per cent.

In Wagner's pot experiments, the average return in seventeen trials from sulphate of ammonium with cereal crops was, in corn 93 per cent., and in straw 92 per cent. of that yielded by nitrate of sodium. In twelve trials on beds freely exposed to weather the return was 83 per cent., both in corn and straw, of that given by the nitrate.

All these results lie between much the same limits. The pot experiments, with their mean return of 93 per cent., may probably be regarded as showing the best average result to be expected from ammonium salts when no great excess of manure is employed or other disturbing conditions are introduced.

There is no certain evidence to show that with different cereals nitrate of sodium or ammonium salts is the more appropriate plant food. The somewhat different relations towards these manures shown by the cereal crops in field experiments are due rather to the special circumstances in which each crop is cultivated than to any partiality of the plant itself. On theoretical grounds it would have seemed probable that oats and barley would have been found especially benefited by nitrate of sodium owing to the larger proportion of alkalies contained in these crops; but this hardly seems borne out by actual experience. In an extensive series of pot experiments by Wagner, in which the different cereals were grown side by side, all sown at the same time, and the manures applied with

the mean return yielded by sulphate of ammonium for  
dred yielded by nitrate of sodium was as follows :—

	Corn	Straw
at . . . . .	99	101
at . . . . .	97	96
at . . . . .	93	93
y . . . . .	79	82

three of the cereals gave fairly equal results, while  
appears as much less favourably affected by the am-  
salt. We can hardly, however, credit barley with any  
capacity to make use of ammoniacal manures in the  
the good returns shown by the field experiments with  
noted in Table II.

*Hay Crops.*—The results obtained with meadow hay given  
II. are very similar in kind to those obtained with  
crops, the comparative return from ammonium salts  
little lower, as we should naturally expect from the  
y of hay to a straw, rather than a corn crop. The mean  
m ammonium salts in the first cutting of hay is 85 per  
that given by the nitrate in three series of experi-  
When the second cutting is included the relative yield  
ammonium salts is increased, rising at Rothamsted from  
per cent. of that given by the nitrate.

Wright's experiments with temporary grass seeds (rye  
and clover) on Scotch farms in 1897, he obtained, from  
of 88 lb. of sulphate of ammonium per acre on three  
five farms, an average return of 81 per cent. of that  
y nitrate, when only the first cutting was regarded.  
the second cutting was included in the result an equal  
was obtained from ammonia and nitrate, as an average  
experiments on three plots on two farms. We have  
further illustration of the fact already noticed, that the  
sulphate of ammonium is prolonged to a later period  
season than is the case with nitrate of sodium.

*Potatoes.*—In the experiments with potatoes at Rotham-  
ammonium salts have given a good return ; this was  
y the case during the earlier years, when the return  
e ammonia fully equalled that from the nitrate. The  
the field have diminished in later years, and the nitrate  
generally yields the best return. The cultivation of  
on heavy land by purely artificial manures cannot be  
on continuously without injury to the physical con-  
f the soil.

results obtained elsewhere have been very various.  
ults, as those obtained by Dr. Aitken at Harelaw, and

by Holdefleiss in Germany, show a much better return from ammonium salts than from nitrate of sodium; while in other cases, as in the trials on twelve Scotch farms in 1897, reported by Professor Wright, the nitrate has often given the best return. Wright believes the difference in effect of the two salts to be connected with the character of the soil, rather than with the climate. Maercker found the two salts nearly equal if superphosphate was applied with both. On the whole, experience seems to point out the potato crop as one for which ammonium salts may be used with special advantage, provided always that potash salts and phosphates are also supplied. In some places where ammonium salts have given the better return when only artificial manures have been employed, nitrate of sodium has done best if dung was also used. The conditions determining the respective advantage of the two salts in potato culture clearly demand further study.

4. *Beetroot and Mangel*.—Beetroot, and its kindred variety mangel-wurzel, are shown by a large number of experiments to be crops specially benefited by nitrate of sodium, a fact which is probably connected with the great need of these crops for alkalis, and their power of flourishing in dry seasons when ammonium salts are least effective. We shall see presently that the return given by ammonium salts is not quite so low as at first appears, if the quality of the produce is taken into account. The mean produce of mangel-wurzel on two plots at Rothamsted during seventeen years shows that the increased weight of crop yielded by ammonium salts is only 76 per cent. of that produced by an equivalent quantity of nitrate of sodium.

On other plots at Rothamsted the mangel crop receives ammonium salts or nitrate of sodium, along with fourteen tons of farmyard manure. On these plots the supply of nitrogenous manure is undoubtedly in excess of the supply of ash constituents, especially of potash; the results obtained are thus not strictly normal. When the two salts are applied alone, the relative return by the ammonium salts is increased, both in root and leaf, but especially in the latter. The return in the total crop, root and leaf, amounts (average of sixteen years) to 93 by ammonia for 100 yielded by nitrate of sodium. The more equal return of the two manures when used with farmyard manure is probably another example of the apparent equality of effect which results from applying more manure than a crop can make use of. The great leaf development which occurs when dung and ammonium salts are employed, implies a prolongation of the period of growth, and is probably due to the interactions between the nitrogenous organic matter and the

um salts already referred to. The farmyard manure retards the nitrification of the ammonia, and the ammonium salts, while it lasts, retards the decomposition of the farmyard

man 3½ cwt. of a high quality superphosphate are used with the ammonium salts and nitrate of sodium in the mangel crop, the return from the ammonia suffers, while the yield of mangel is increased. As the result of this double action, the relative returns from ammonium salts and nitrate of sodium become 59 and 100 for roots, and 72 and 100 for the mangel crop. Field experiments are clearly required to determine the most profitable way of applying artificial manures to the mangel. The addition of superphosphate and alkali salts to the soil at the same time that the dung and the ammonium salts are applied must tend to retard the nitrification of both. Better results would probably be obtained if the superphosphate and nitrate were applied to the land at a much earlier period. Ammonium salts should also be mixed with the soil, and not applied only on the dung.

An excellent series of experiments on mangel-wurzel was carried out by the Bath and West of England Society in 1890 on several farms of very various character. In these experiments 100 lbs. of sulphate of ammonium per acre were applied with superphosphate, 2 cwt. at the time of sowing the seed, and with a top-dressing. Of the 4 cwt. of nitrate of sodium used on a comparative plot, 1 cwt. was applied at sowing the seed, and 3 cwt. was applied subsequently in two top-dressings. The season was favourable to the mangel crop, and a good produce was obtained. As a mean of all the results, the increase of roots given by the sulphate of ammonium was 79 per cent. of that given by the nitrate.

Mr. G. H. Raper quotes ten series of field experiments on sugar beet carried out by English and German experimenters; in every one of these the increase of roots given by nitrate of sodium considerably exceeded that given by ammonium salts.

*Turnips.*—The turnip crop, as grown in an ordinary rotation, differs much from the crops we have already mentioned in its requirement of nitrogenous manure. Grown in land which is fully disintegrated by ample tillage, and having the whole of the summer and autumn for its development, it frequently stands in need of nitrogenous manure, and phosphates are found to be more effective than ammonium salts or nitrate of sodium. In the case of turnips no continuous series of trials has been published. In the Rothamsted long-continued experiments with turnips only very small crops were obtained, owing apparently

to the absence of potash in the manures, and the difficulty of obtaining a good tilth under the conditions of the experiment.

A very large number of experiments on turnips have been conducted simultaneously on various farms in Scotland under the direction of Dr. Aitken or Prof. Wright, and in the North of England by Dr. Somerville. Only small quantities of nitrate of sodium (generally 1 cwt.), and of sulphate of ammonium (generally  $\frac{1}{2}$  cwt. per acre), have been employed. The return from these small dressings, when used with superphosphate and potash salts, has been generally pretty equal; and it would appear that in a moist cool climate there is little difference in the return to be expected in turnip roots from the use of these two salts.

We will not occupy space by discussing the few experiments made upon the less important farm crops. There is always the same tale to tell. The return, per unit of nitrogen applied, is on an average smaller when ammoniacal manures have been used than when nitrate of sodium has been employed. What is the reason of this generally observed fact?

**Causes of less Return from Ammonium Salts.**—Wagner answers the question by saying that a considerable loss of the nitrogen of the ammonia takes place during the process of nitrification in the soil. In his own experiments on nitrification in soil, he calculates that the nitric acid produced from the ammonium salt added never exceeded 88 or 89 per cent. of the quantity which should theoretically be found. That a loss of 11 or 12 per cent. of the nitrogen in the manure actually occurred is, however, very uncertain. Wagner apparently assumes that the nitrification of the organic matter of the soil proceeded at the same rate when an ammonium salt was present as when no manure had been applied; this assumption is unproved, and is in itself improbable. It is clear also, from his own pot experiments, that a much smaller deficiency than 11 or 12 per cent. may occur when the yield in crops given by sulphate of ammonium is compared with the yield given by nitrate of sodium.

Without presuming to be able to explain all the facts, a few points seem clear. A part of the superiority of nitrate of sodium is not due to its nitrogen, but to its soda, which, as we have had already occasion to remark, occurs in a condition peculiarly suitable for plant use.

Ammonium salts are also liable to loss of ammonia when applied to the land as top-dressings. The far better return obtained at Woburn than at Rothamsted by top-dressing wheat with ammoniacal salts is very probably connected with the fact that the Rothamsted soil contains about 3 per cent. of chalk, while the Woburn soil is almost free from carbonate of calcium.

In the barley experiments, the return at Rothamsted for the ammonia applied is far better than in the wheat experiments, and exceeds the return found at Woburn; in this case the ammonium salt is not top-dressed at Rothamsted, but ploughed into the land before sowing the seed.

Again, the time occupied in the nitrification of the ammonia; the deferred nitrification of the soil; and the smaller mobility of nitrate of calcium as compared with nitrate of sodium, all unite in demanding a longer time for the nitrogen in the form of ammonia to produce the same effect upon a growing crop than that in the form of nitrate of sodium. When the period available is too short, an unused residue of plant food remains in the soil. This general fact is illustrated by the larger second cutting of grass at Rothamsted where ammonium salts instead of nitrate have been employed, and by the much more considerable residue of nitrates remaining in the wheat and barley fields at Woburn after manuring with ammonium salts than after nitrate of sodium has been employed.

**Relative Quality of Produce.**—The smaller quantity of produce yielded by ammonium salts is in some cases more or less atoned for by a somewhat superior quality. The more gradual growth obtained from ammoniacal manures leads, in some cases, to a more perfect maturation of the produce.

The average weight per bushel of cereal grain is on an average a little greater when the manuring has been with ammonium salts than when nitrate of sodium has been used, as will be seen from the following average results obtained at Rothamsted and Woburn on plots to which a full supply of cinereal manure has been given. The Rothamsted weights per bushel of wheat are the average of 30 years, of barley 20 years, of oats 5 years. The weights of the wheat grain at Woburn are the average of 20 years, and of barley 16 years.

*Comparative Weight per Bushel of Cereal Grain manured with Ammonium Salts and Nitrate of Sodium.*

	Wheat		Barley		Oats	
	Ammonia	Nitrate	Ammonia	Nitrate	Ammonia	Nitrate
	lb.	lb.	lb.	lb.	lb.	lb.
Rothamsted . . .	59½	59½	54½	54	37	35½
Woburn . . .	58·7	57·8	53·4	52·7	—	—
„ . . .	58·7	57·0	52·7	51·7	—	—

The wheat grain grown with ammonium salts, superphosphate and alkalis at Woburn in 1897, was reckoned by experts as worth 2s. to 2s. 6d. per quarter more than that grown on the

corresponding plots with nitrate of sodium (Journal R.A.S.E., 1898, p. 551).

With the weight per bushel go the other qualities belonging to maturity. The malting value of the barley grown at Rothamsted is thus higher when manured by ammonium salts than when manured with nitrate of sodium (Journal R.A.S.E., 1897, p. 65.)

The Rothamsted grass experiments supply excellent examples of the effect on the quality of the hay of a very long-continued use both of nitrate of sodium and ammonium salts. It may be generally stated that the larger crop given by the nitrate contains a much greater variety of herbage, including both leguminous plants and weeds, than is yielded by the corresponding plot receiving ammonium salts, the hay from which consists to a greater extent of true grasses; but it is impossible to say which produce has the higher feeding value without actual experiments on animals.

In the Rothamsted experiments with potatoes, the average percentage of dry matter in the tubers during twenty years has been the same, whichever of the two salts was employed.

In the case of sugar-beet and mangel-wurzel, grown without dung, the quality of the roots is distinctly better when ammonium salts are used in the place of nitrate. The improvement in quality is not, however, so great as to override the very superior weight of produce yielded by the nitrate. Thus in the three years' experiments with sugar-beet at Rothamsted the average relative productiveness of nitrate of sodium and ammonium salts for roots (means of Plots 4 and 6) was 100 to 69; while for sugar it was 100 to 79. In the four years' experiments with mangels, the relative increase of roots (means of Plots 4 and 6) by nitrate and ammonia was as 100 to 70; while the increase of sugar per acre was as 100 to 82. To the manufacturer of sugar, the increased percentage of sugar in the roots grown with ammoniacal manures means also increased economy in working, as the higher is the percentage of sugar in the root the smaller is the proportion of non-crystallisable matter which prevents a profitable return in the process of manufacture.

When both the nitrate and the ammonium salts were used at Rothamsted together with 14 tons of farmyard manure, the returns obtained in the form of sugar were irregular. In three years' experiments with sugar-beet the increase of sugar per acre by nitrate of sodium was to that given by ammonium salts as 100 to 89; and when superphosphate was used with the farmyard manure as 100 to 52. But in four years' experiments with mangel-wurzel the ammonium salts gave by far the best return—namely, 181 of sugar for 100 yielded by the nitrate; and

sugar for 100 by the nitrate when superphosphate was with the manure. Neither the nitrate nor the ammoniacal salts yielded as much sugar when applied with the superphosphate when used without it, but of the two the ammoniacal was decidedly the best.

### RELATIVE MONEY VALUE.

Sulphate of ammonium and nitrate of sodium contain very different proportions of nitrogen. We have also seen that the effect of these two manures has not always the same relative effect. The farmer has thus a somewhat complicated question to solve when he desires to know whether it is more economical for him to purchase the one or the other manure. The proportion of nitrogen in each manure does not vary. The best sulphate of ammonium will contain about 25 per cent. of ammonia, and good qualities will rarely fall below 20 per cent. Nitrate of sodium is sold on a guarantee of 90 per cent. purity; the nitrogen it contains is thus equal to 14 per cent. of ammonia. The mean relation between the two is thus as  $24\frac{1}{2}$  to 19. Consequently  $24\frac{1}{2}$  lb. of nitrate of sodium will usually supply the same quantity of nitrogen to the soil as 19 lb. of sulphate of ammonium.<sup>1</sup>

We have already seen that the relative productiveness of the nitrogen of the two manures varies a good deal according to the character of the soil, the time and mode of application, the other manures associated with them, the nature of the crop, and the experience during the growing season. Looking at the average results, given in Table II., and in the discussion of it, it appears that while sulphate of ammonium is in some cases nearly equal to nitrate of sodium in its effect, yet in a large number of cases its productiveness falls below that of the nitrate. In Table III. (p. 344), the attempt is made to show what is the relative money value of sulphate of ammonium for every variation in the effect of nitrate of sodium. The calculation is made in the following place on the assumption that the nitrogen in the two manures is equally productive, while in other columns is shown the equivalent money value of sulphate of ammonium when its effect is 5 per cent., 10 per cent., 15 per cent., and 20 per cent. below that given by nitrate of sodium. The manures are assumed to be of the average composition

1. A sulphate of ammonium contains  $25\frac{1}{2}$  per cent. of ammonia, 3 lb. will contain the same amount of nitrogen as 4 lb. of nitrate of sodium, or  $\frac{3}{4}$  cwt. is equivalent to 1 cwt. When sulphate of ammonium contains  $23\frac{3}{4}$  per cent. of ammonia, 4 lb. will be equivalent to 5 lb. of nitrate, or  $89\frac{1}{2}$  lb. to

TABLE III.—*Equivalent Values per Ton of Nitrate of Sodium and Sulphate of Ammonium.*

Price per ton of nitrate of sodium	Equivalent price per ton of sulphate of ammonium				
	Nitrogen same value as in nitrate	Nitrogen 5 per cent. less value	Nitrogen 10 per cent. less value	Nitrogen 15 per cent. less value	Nitrogen 20 per cent. less value
£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
5 0	6 9	6 3	5 16	5 10	5 3
5 10	7 2	6 15	6 8	6 1	5 14
6 0	7 15	7 7	6 19	6 12	6 4
6 10	8 8	7 19	7 11	7 3	6 14
7 0	9 1	8 12	8 3	7 14	7 4
7 10	9 14	9 4	8 14	8 4	7 15
8 0	10 6	9 16	9 5	8 15	8 5
8 10	10 19	10 8	9 17	9 6	8 15
9 0	11 12	11 1	10 9	9 17	9 6
9 10	12 5	11 13	11 1	10 8	9 16
10 0	12 18	12 5	11 12	10 19	10 6
10 10	13 11	12 17	12 4	11 10	10 17
11 0	14 4	13 10	12 15	12 1	11 7
11 10	14 17	14 2	13 7	12 12	11 17
12 0	15 10	14 14	13 19	13 3	12 8
12 10	16 3	15 6	14 10	13 14	12 18
13 0	16 15	15 19	15 2	14 5	13 8
13 10	17 8	16 11	15 13	14 16	13 19
14 0	18 1	17 3	16 5	15 7	14 9
14 10	18 14	17 15	16 17	15 18	14 19
15 0	19 7	18 8	17 8	16 9	15 10
15 10	20 0	19 0	18 0	17 0	16 0

already mentioned. This table will, it is hoped, be of some assistance in deciding which manure is at any time the more economical to purchase.

In the hope of rendering this study of the properties and action of sulphate of ammonium and nitrate of sodium more easily available for the use of practical men, we will now proceed to summarise very briefly the chief conclusions arrived at.

#### PRACTICAL SUMMARY.

1. On land containing no carbonate of calcium, sulphate of ammonium cannot be profitably used as a manure, but nitrate of sodium may be used.

2. On land containing a large amount of carbonate of calcium, sulphate of ammonium will seldom give its best return if applied as a top-dressing. On such land the proper course is to cover the manure with soil by plough or harrow immediately after it has been distributed upon the surface.

ough sulphate of ammonium may often be successfully a top-dressing upon ordinary land, it gives its best most certainly when it is ploughed or harrowed in before the seed. It is thus specially suitable for application to corn and potatoes.

Ammonium salts do not become available as plant food have become converted into nitrate of calcium. This conversion will not take place in a dry soil, but in most arable soil will speedily occur in showery weather.

Nitrate of sodium, being immediately available as plant food, distributing itself in the soil more rapidly than the nitrate of calcium arising from the nitrification of sulphate of ammonium, is generally more suitable for use as top-dressings on crops and for late applications.

The effect of sulphate of ammonium is always more than that of nitrate of sodium, and is especially marked in soils containing little lime, and in old grass land, associated with organic manures. This implies a more rapid or a longer continuance of growth in the crop receiving it, and results in some cases in a better quality of produce.

The character of the climate or season frequently determines whether nitrate of sodium or sulphate of ammonium is the more profitable manure. In a dry season nitrate of sodium always gives a better return for the same quantity of manure applied, while in a wet summer the advantage is generally with the ammonium salt. This influence of climate is clearly seen in the case of cereal crops, or on grass land; it is also perceived in the case of crops like potatoes and other crops which have a long period of growth.

The greater crop frequently given by nitrate of sodium is not due to the soda which it supplies, the soda acting only both in the soil and in the plant.

The produce yielded by sulphate of ammonium is more than that obtained on the presence in the soil of an abundant supply of plant food than is the case when nitrate of sodium is used. Kainite is an excellent addition to sulphate of ammonium.

On an average of 10 series of field experiments with various crops, continued throughout many years, in which equal quantities of nitrogen in the forms of nitrate of sodium and ammonium salts were applied to soils well supplied with soda, and phosphates, the average return in corn was 100 by ammonium salts for 100 by nitrate of sodium, and in wheat 100 by ammonia for 100 by nitrate. The return in corn was not very different by the two manures, but the return

in straw is considerably larger when nitrate of sodium is used. The quality of the corn was a little better where ammonium salts had been employed.

11. In three series of field experiments on *Grass hay*, conducted in the manner just described, the average return by ammonium salts was 85 per cent. of that given by nitrate of sodium, when the first cutting of hay was alone considered. When the second cutting of hay was included, the return by ammonium salts was in two series of experiments 88 per cent., or more, of that given by the nitrate.

12. In the first ten years of the Rothamsted experiments with *Potatoes* the produce by ammonium salts was on an average fully equal to that yielded by nitrate of sodium. No dung was used, but alkali salts and superphosphate were applied.

13. The weight of *Mangel roots* yielded by ammonium salts during 17 years at Rothamsted was on an average only 76 per cent. of that yielded by nitrate of sodium; but when the superior quality of the roots grown by ammonium salts is taken into account, the return by the ammonia is probably 82 per cent. of that given by the nitrate. No dung was used, but alkali salts and superphosphate were applied.

14. The farm experiments made on *Turnips* in Scotland and the North of England, with small quantities of sulphate of ammonium and nitrate of sodium, generally do not show any considerable difference in the effect of these two manures.

15. Low qualities of nitrate of sodium should be avoided by the farmer, as it is possible they may contain an injurious amount of perchlorate of potassium. Low qualities of nitrate should be used for mangel rather than for cereal crops.

16. Sulphate of ammonium of average quality will contain  $24\frac{1}{2}$  per cent. of ammonia. Nitrate of sodium of 95 per cent. purity will contain nitrogen equivalent to 19 per cent of ammonia. Nineteen pounds of sulphate of ammonium will thus supply as much nitrogen as  $24\frac{1}{2}$  lb. of nitrate of sodium.

17. If the nitrogen in the two manures produced the same effect on crops, their money value would be determined simply by their contents in nitrogen. Thus when nitrate of sodium was 8*l.* a ton, sulphate of ammonium would be worth 10*l.* 6*s.* Under various circumstances, already described, the nitrogen in sulphate of ammonium is sometimes as effective as that in nitrate of sodium, and sometimes gives a smaller return. The relative money value of the two manures, under varying circumstances of yield, is shown in Table III. (p. 344).

R. WARINGTON.

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# Official Reports.

## REPORT OF THE COUNCIL

TO THE

ANNUAL ANNIVERSARY GENERAL MEETING OF GOVERNORS  
AND MEMBERS OF THE SOCIETY,

HELD AT THE SOCIETY'S HOUSE,

13 *Hanover Square, W.*,

ON TUESDAY, MAY 22, 1900,

BY J. H. THOROLD, BART. (Trustee), in the Chair.

The Council have to report the following changes in the list of Governors and Members during the year which has elapsed since the Anniversary Meeting in May 1899 :—276 Members have been elected to the Society, and 12 Members have been reinstated under Bye-law 10, whilst the deaths of 1 Annual Governor, 1 Foundation Governor, 4 Life Governors, 1 Honorary Member, 58 Life Members, and 136 Annual Members have been reported. A total of 1,000 Members have been struck off the books under Bye-law 10, for absence of addresses ; 72 under Bye-law 11, for arrears of contributions ; and 195 have resigned.

Amongst other Governors and Members whose loss by death the Society has had to deplore since the General Meeting in May last are : the Duke of Westminster, K.G. (a Trustee of the Society), the Marquess of Lothian, K.T., the Marquis of Winchester, the Earl of Lonsborough, Earl Manvers, Lord Ludlow, Lord Carnaby Lennard, Bart., Sir James Paget, Bart., F.R.S., Mr. E. Colman, Mr. Henry Gold of Hedsor, Mr. John Maple, Mr. El Pidgeon (a Member of the Council), and Mr. William Wollaton, Nottingham.

These and other changes bring the total number of Governors and Members now on the Register to 10,666, divided as follows :—

▲ ▲ 2

- 9 Foundation Life Governors (Members elected before the granting of the Charter on March 26, 1840) ;
- 71 Governors paying an annual subscription of 5*l.* ;
- 102 Life Governors ;
- 6,832 Members paying an annual subscription of 1*l.* ;
- 3,506 Life Members ;
- 122 Life Members by Examination ;
- 24 Honorary Members ;

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10,666 Total number of Governors and Members,  
as against a total of 10,879 Members at the same period last year.

4. Two vacancies on the Council have occurred since the date of the last Meeting in December, through the lamented deaths of the Duke of Westminster and Mr. Daniel Pidgeon. The last public appearance of the Duke of Westminster was at the December General Meeting of this Society ; and by his death on December 22 agriculture has lost one of its staunchest supporters and the Royal Agricultural Society a firm and generous friend. The Duke was President of the Society when the highly successful Meeting of 1893 was held at the historic city of Chester, with which he was so closely identified ; and he was at the time of his death a Trustee of the Society and of Harewood House. Mr. Daniel Pidgeon, who died at Assouan, in Egypt, on March 13 last, had been a Member of the Council since June 1889, and had rendered valuable service to the Society, particularly on the Journal and Implement Committees. The Society's Journal was also indebted to him for a number of interesting and attractively written articles contributed by him to its pages.

5. To the vacant Trusteeship of the Society caused by the death of the Duke of Westminster, Earl Cawdor (Vice-President) has been appointed. The Hon. Cecil Parker has succeeded Earl Cawdor as Vice-President, and Mr. R. M. Greaves, of Wern, Portmadoc, North Wales, has been elected a Member of the Council. As the late Mr. Pidgeon's term of office as a Member of Council would have expired this year, the vacancy caused by his death will have to be filled up by the General Meeting ; and Mr. R. W. Eddison, of The Manor, Adel, Leeds, has been duly nominated for the position in accordance with Bye-law 23 (c).<sup>1</sup>

6. The unsatisfactory financial result of the Maidstone Meeting (a loss of 6,382*l.* 1*s.* 11*d.*), reported by the Council in December, will have prepared the Members for a considerable diminution in the Assets of the Society at the end of 1899 as compared with 1898. The total Assets at December 31 last, as certified by the Accountants and Auditors, amounted to 37,418*l.* 15*s.* 7*d.*, as against 45,807*l.* 4*s.* 6*d.* at the end of 1898. This decrease of 8,388*l.* 8*s.* 11*d.* is accounted for by the loss on the Maidstone Meeting, by the deduc-

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<sup>1</sup> By Mr. Eddison's lamented death, after an illness of only four days, on the night of May 21, this nomination became void.

tions made at the customary rates for depreciation, and by the amount brought into current account from the "Reserve Fund" to represent the contributions of Life Members to the revenue of the year. At the request of the Council, the three Auditors appointed by the Members have made a special examination of the Society's financial position as at the end of 1899, and the very clear report which they have presented was published for general information in the last number of the Journal, together with the Balance Sheet and Statements of Receipts and Expenditure for 1899. With regard particularly to the "Reserve Fund," which was created in 1891 at the suggestion of the then Auditors to represent that portion of the Society's Assets which might be regarded as earmarked to provide for the unexhausted privileges of the Life Members whose compositions had been accepted by the Society in the past, the Auditors reported as follows: "The existing Reserve Fund (at December 31, 1899) of 20,786*l.* 2*s.* 7*d.* would appear to be adequate to meet the prospective claims of Life Members, but not much more than adequate if the proportion should be appreciably modified of Life Members whose annual contributions to income are paid out of the Reserve Fund, and of the other Members who pay a subscription of 1*l.* every year."

7. As already announced, the Society's Meeting of the present year will be held, under the presidency of His Royal Highness the Prince of Wales, on the Knavesmire in the City of York from June 16 to 22 next. In the Implement Department, the number of feet of Shedding (exclusive of open Ground Space) actually allotted is 14,772 feet in 412 Stands, as against 12,200 feet at Maidstone last year, 15,491 at Birmingham in 1898, 12,473 at Doncaster in 1891, and 13,136 feet at the previous Meeting at York in 1883.

8. For the Prizes of 40*l.* and 20*l.* offered by the Society in connection with the York Meeting, for General Purpose Horse-Power Cultivators, 18 Entries have been made by seven Exhibitors; and for the similar Prizes of 40*l.* and 20*l.* offered for Self-moving Steam Diggers, 2 Entries have been made. The competitive Trials of the Machines entered in these two Classes will be held on land at Kexby, about six miles from York, and will commence on Tuesday, June 12. There will also be competitive Trials of the following Classes of Implements in the Showyard itself: on Wednesday, June 13, of the two Milking Machines entered for the Society's Prize of 50*l.*, and on Tuesday, June 19, of Sheep-shearing Machines. For the Prize of 20*l.* offered for the best "Sheep-shearing Machine driven by power other than hand-power," 6 Entries have been made by three Exhibitors; and for the Prize of 10*l.* offered for Hand-Power Machines, 5 Entries have been made by three Exhibitors. Fifty Machines and Appliances of various descriptions have been entered as "New Implements" for the Society's Silver Medal.

9. The Implement Yard and the Dairy will be opened to Members of the Society and the public on Saturday, June 16, and the charge of admission to Non-Members will be 2*s.* 6*d.* The

Judging of all Classes of Produce will also take place on this day. On Monday, June 18, the charge for admission will be 5s., and all the Classes of Live Stock and Poultry will then be judged. On Tuesday and Wednesday the charge for admission will be 2s. 6d. each day ; and on the last two days, Thursday and Friday, it will be 1s. each day.

10. The total number of entries of Live Stock is 1,997 (696 horses, 687 cattle, and 614 sheep), which is practically the same as the total number of entries of these descriptions of Live Stock at the last Meeting of the Society held in Yorkshire (at Doncaster) in 1891, and is 500 more than the previous Meeting held at York in 1883. The Council had contemplated, as usual, an exhibition of Pigs in connection with this year's Meeting, and had included the customary classes for Pigs in the Prize-sheet. On January 26 last, however, the City of York was, by an Order of the Board of Agriculture, declared a "Swine Fever Infected Area," and that Order is still in force. The Council have considered the situation thus created on several occasions since January ; but as from the latest information received by the Society there appeared no probability of the present restrictions being removed at an early date, the Council, acting upon the opinion of the Society's Veterinary Advisers, felt there was no alternative but to abandon with regret any exhibition of Pigs this year.

11. In the other Departments of the York Meeting there are 629 entries of Poultry, 168 of Butter, 84 of Cheese, 107 of Cider and Perry, and 169 of Hives, Honey, &c. Competitions for Shoeing Smiths (open to the United Kingdom) will be held on the Tuesday and Wednesday, and 55 entries in all have been received. A lecture on the "Horse's Foot, and How to Shoe It" will be delivered in the Shoeing Forge at noon on the Thursday of the Meeting. Daily demonstrations of Butter- and Cream Cheese-making will be given by Miss M. Brown in the Dairy in the Showyard.

12. In the Report of the Council presented at the last Anniversary Meeting in May 1899, the receipt was announced of an invitation from the Corporation of Cardiff for the holding of the Society's Meeting of 1901 in that town. Unexpected local difficulties arose which prevented part of the site originally offered by the Corporation being placed at the disposal of the Society ; but the use of other land has now been arranged for, and at the Meeting of the Council held on April 4 last the Seal of the Society was formally affixed to the agreement with the Corporation for the holding of the Meeting of 1901 at Cardiff. In accordance with customary practice, the detailed Prize-sheet for Live Stock, Poultry, and Produce will not be considered until after the autumn recess ; but the Council have already allotted 5,000*l.* for the prizes, and have decided that the competition in the Cattle classes for females of three years old and upwards shall be limited to cows-in-milk. In the Implement Department they have announced the following competitive trials :—

*Class I.* Portable Oil Engines (power not to exceed 15 B.H.P.).

Prizes offered : First Prize, 40*l.* ; Second Prize, 20*l.*

*Class II.* Agricultural Locomotive Oil Engines (power not to exceed 30 B.H.P.). Prizes offered : First Prize, 40*l.* ; Second Prize, 20*l.*

*Class III.* Small Ice-making Plant, suitable for a Dairy (output not to exceed 4 cwt. in 10 hours). Prize offered, 15*l.*

The regulations for these Trials have already been issued, and are printed in Part I. of the Society's Journal for the present year.

13. It has been usual at the Anniversary General Meeting to "declare" the District in which the Society's Meeting is intended to be held two years afterwards. The Meeting of the present year, 1900, will be held in District E (Yorkshire) ; that of 1901 in District F (West Midlands and South Wales) ; and, in accordance with the Scheme of Rotation settled in 1892, it has been decided by the Council that, provided some suitable and adequate site be offered for the purpose, the Meeting of 1902 shall be held at some town in District G (comprising Cheshire, Lancashire, and North Wales).

14. With the Meeting of 1902, the present Rotation, which commenced at Cambridge (District A) in 1894, will come to an end ; and in view of the anxieties which have been experienced by the Council through the ever-growing size of the Shows and the difficulties and expense of securing and adapting suitable sites of adequate dimensions, they felt it to be advisable that, before any new scheme of rotation was entered upon, the whole of the Society's existing arrangements as to the holding of Shows of Live Stock, Implements, and Produce should be passed in review.

15. Accordingly, as announced to the Members in the Report to the General Meeting held last December, the Council decided to remit to a strong Committee, which included the Chairmen of all the permanent Committees concerned in the administration of the Shows, the three past and present Honorary Directors, and other Members of the Council experienced in Show requirements either as Stewards or as Exhibitors, the important and responsible duty of suggesting in what way the existing Show system might be modified in the future—after the present rotation was completed in 1902. This Special Committee, appointed on July 26 last, presented on February 5 a very valuable and exhaustive Report, which has been published in the Journal for the information of the Members, and which brings to a focus all the considerations which demand attention in connection with the admittedly difficult problem of the future of the Society's Shows.

16. In view of all the circumstances which are detailed by the Committee in their report, they arrived at the conclusion that "they could not take the responsibility of advising the Council to commit the Society to the holding of another series of Shows on the

basis of the existing rotation." They pointed out the serious difficulties arising from the absence at the present time (and in a more acute form in the future) of suitable sites within reasonable distance of the large towns to which alone the Society can afford to go with any reasonable hope of recouping itself for the immense preliminary expenditure entailed upon it by the present-day requirements of exhibitors and visitors. They drew attention to the serious financial risk caused by the holding of Shows at smaller places such as Maidstone (which, as mentioned above, involved a net loss to the Society's general funds of no less than 6,382*l.*); and they urged that the Society was "bound to take due precautions that the general interests of the Members should not be prejudiced or the usefulness imperilled of the other important departments of public work to the continuance of which the Society is pledged, by the outlay on the Shows attaining too hazardous proportions."

17. In summing up the whole matter, the Committee reported that, "taking into consideration all the facts of the case, they have arrived at the conclusion that if the Society's Shows are to fulfil their proper function in the future, without an unwarrantable drain upon the Society's general resources, it would be desirable that if possible they should be held upon a permanent location near some large town (preferably in the centre of England) which would be convenient for railway access from all parts of the country. In fact, the endeavour of the Society in the future should be to bring the people to the Show, and not the Show to the people."

18. This important Report, presented to the Council Meeting held on February 7, was at once printed and generally circulated; and it was only to be expected that hesitation should be felt in some quarters as to the necessity for, and expediency of, so considerable a change from the Society's present system of migratory Shows. The facts adduced by the Committee, and the arguments they present in support of their recommendations, have not, however, been successfully impugned; and after a very full debate on March 7, in which all shades of opinion in the matter were represented, the Council decided, by 38 votes to 4, upon the adoption of the Report.

19. The Special Committee have since been reappointed, with instructions to make inquiries as to any possible sites for a permanent Showyard, and to prepare estimates of expense. In this inquiry they are still engaged, and it will not of course be possible for them, for some time to come, to present any definite recommendation in the matter. Meanwhile the authorities of several important towns are moving in the direction of assisting the Council in the selection of suitable sites in their vicinity; and the Committee will be grateful for any suggestions which may be made to them as to sites which fulfil the Society's requirements. The most desirable plan would undoubtedly be for the Society to be placed in the position of

for a portion of the year of the ground selected, rather than have any responsibilities for the purchase of land and its management during the whole of the year.

The holding of an Annual Show is, as the Members will be only one of the numerous functions of public usefulness by the Society; and if the other departments of the operations do not bulk so largely in the Proceedings of Council or in the Half-Yearly Reports to the Members as the Shows already held or arranged for, it is none the less important for the general well-being of the Society that it should be maintained upon their present scale, and that facilities should not be lost as they arise of improving such departments and expanding them in other directions. The Society has sent to its Members a Quarterly Journal; and, commencing in the present year, this Journal will now, for the greater convenience of Members and more expeditious delivery, be issued by post instead of parcel post as formerly. The preparation and printing of the articles for this Journal, the printing and binding, of necessity cost a considerable sum per annum. The Society retains the services of Chemical, Botanical, Zoological, and Veterinary Experts, for giving advice and assistance to Members, and for general scientific research. It makes a substantial amount for chemical and botanical experiments and for inquiries into the diseases of animals; and it holds annually two expensive Examinations for testing and awarding Diplomas the qualifications of students of Agriculture and Farming. None of these departments of work ought, in the interests of the Society, to be given up or diminished, and are susceptible of useful development.

As to the work of the Chemical Department in the Society's laboratory during the last six months, Dr. Voelcker reports that on December 1, 1899, 323 samples have been sent by Members of the Society for analysis, as compared with 425 submitted in the corresponding period of last year. The Chemical Committee have to know that an important service has been rendered to Members by attention being called, through their periodical reports, to points of interest and matters affecting the purchase of Fertilisers and Feeding Stuffs. At the Woburn Farm, experiments are in progress for testing (1) the feeding to Sheep of Manure at an earlier date than is usual in practice, and (2) the value of Fertilisers for Bullocks. The Field Experiments are being continued and will be reported hereafter. An account to date of the experiments at the Pottery Station at Woburn has been prepared, and will appear in the next Number of the Journal.

Under Clause 4 of the Deed of Foundation, dated February 1894, of the Lawes Agricultural Trust, munificently founded by the late Sir John Lawes to provide for the continuance of the highly important and valuable agricultural experiments at Rothamsted, two

of the nine Members of the Committee of the Trust are to be appointed by the Royal Agricultural Society. The representatives of the Society on the Committee have heretofore been Earl Cawdor and Sir John Thorold, Bart. ; but, as Lord Cawdor has retired from the Committee, the Council have appointed in his place Dr. J. Augustus Voelcker, the Society's Consulting Chemist.

23. The series of Grass Experiments conducted by the Society for the past five years in different parts of the country have been concluded, and a report upon them appears in the March Number of the Journal. Certain of the experimental plots will continue to be kept under observation. Experiments are now being conducted at the Pot Culture Station at Woburn as to the means of eradicating certain prevalent weeds of the farm. During the half-year information has been given by the Consulting Botanist as to the names and nature of many weeds, and the best means for their extirpation. Injury to Broccoli caused by *Peronospora* and Bacteria, producing what is locally called "blindness," is being investigated. Many other fungal attacks have been reported on. A case of poisoning from eating the leaves of *Rhododendron* has been investigated, and other inquiries answered.

24. At the instance of the Royal Commission for the Paris Universal Exhibition, the Council have caused to be prepared, under the direction of the Consulting Botanist, and have despatched to Paris, a series of 37 specimens of different varieties of British grain, which will be shown in the agricultural department of the British Section of the Exhibition.

25. Though little of special interest has occurred in the Zoological Department during the last six months, there has been a steady demand by Members for the advice of the Society's Zoologist with regard to certain perennial pests, especially those infesting stored agricultural produce. Inquiries have been received concerning wireworm, surface caterpillars, and chafer grubs, and several cases of parasitic diseases of poultry and pheasants have been dealt with.

26. During the last six months there has been an appreciable decline in the number of outbreaks of swine-fever, and a distinct increase in those of glanders. Outbreaks of anthrax have occurred with about the same frequency as during the preceding six months, and no case of rabies has been detected since the month of December last. The most notable feature of the period, with regard to the occurrence of the contagious diseases, was the reappearance of foot-and-mouth disease at the end of January last. In all, nine outbreaks were detected, the latest of which occurred in Hertfordshire this month. During the first week of April foot-and-mouth disease was detected among a cargo of Argentine cattle landed at Deptford, and since that date a large number of cargoes have arrived at Deptford and Liverpool containing both cattle and sheep extensively affected with the disease ; but no case among British cattle traceable to this introduction of the contagion has been reported.

The number of morbid specimens forwarded during the year to the Department of Comparative Pathology and Zoology, established at the Royal Veterinary College by the annual grant of 500*l.* from the Society, was 208. The majority of these were sent for examination with a view to diagnosis. By the aid of a special grant from the Society, the Subcommittee appointed for the purpose have continued the experimental inquiry with regard to Tuberculin, and a report on the results will shortly be presented to the Council.

It was announced in the December Report that arrangements had been made in concert with the Highland and Agricultural Society for the establishment, under the control of a National Agricultural Examination Board appointed by the two Societies, of a scheme for an annual examination for a National Diploma in Science and Practice of Agriculture. The first examination for the Diploma was held, by the courtesy of the Governors, in the Great Hall of the Yorkshire College, at Leeds, on April 30 last, and four days. The examination for the Diploma will normally be held once in two years and be taken by the candidates in two Divisions; but this year, exceptionally, candidates were allowed to sit in both Divisions at once, so as to meet the convenience of candidates who might have been studying for either of the separate examinations of the two Societies now replaced by the new Joint Examination. As a result, the large number of 53 candidates sat for themselves, of whom no fewer than 30 asked permission to sit in both Divisions this year.

The results of the Examination, as announced by the Agricultural Examination Board, are that 7 candidates passed the Examiners in all the ten subjects of Examination, and are entitled to receive the National Diploma in Agriculture; but 7 other candidates have been successful in passing in five subjects included in Division I. (Mensuration and Land Surveying, Agricultural Botany, General Chemistry, Geology, and Agricultural Entomology), and will therefore be entitled to come next year for Examination in Division II. (Practical Agriculture, Agricultural Book-keeping, Agricultural Chemistry, Agricultural Engineering, and Veterinary Science), when such of them as are successful will be awarded the Diploma.

The seven candidates who passed in both Divisions of the Examination, and will therefore receive the National Diploma, are (in order of merit) as under:—

- GEORGE POTTS, Durham College of Science, Newcastle-on-Tyne.—(Diploma with Honours and Gold Medal.)
- HENRY LAWRENCE SCHNEIDER, South-Eastern Agricultural College, Wye, Kent.
- EDWARD WORTHY JAMES THOMPSON, University College of Wales, Aberystwyth.

4. JOHN ROBERTS, University College of Wales, Aberystwyth.
5. SELWYN ELD DURANT, South-Eastern Agricultural College, Wye, Kent.
6. SAMUEL SIMPSON, Harris Institute, Preston ; and University, Edinburgh.
7. ERNEST CHRISTOPHER BROWN, Yorkshire College, Leeds.

The seven candidates who passed in Division I. of the Examination are (in alphabetical order) as under :—

SIMON BLORE, University College of Wales, Aberystwyth.

BERNARD WILLIAM BULL, Ramsden, near Billericay, Essex.

JOHN HENRY JOSEPH FARQUHAR, Durham College of Science, Newcastle-on-Tyne.

JOHN MONTGOMERIE HATTRICK, West of Scotland Agricultural College, Glasgow.

ALBERT WILLIAM OLDERSHAW, Glebe Farm, Costock, Notts.

GEORGE WATSON PATERSON, Agricultural College, Aspatria.

THOMAS YOUNG, Jun., Newbigging House, Methven, N.B.

31. The Annual Examinations held in the Autumn for the National Diploma in the Science and Practice of Dairying will be held as before at the Reading College and British Dairy Institute (for English candidates) from September 24 to 27 next, and at the Scottish Dairy Institute, Kilmarnock (for Scottish candidates), from October 2 to 5. The entries for both these Examinations will close on August 31, 1900.

32. The Education Committee of the Council, having considered the question of elementary education in rural districts, presented for confirmation to the Council on March 7 the following resolution, which, having been adopted, was submitted to the Education Department : " That in rural elementary schools it is desirable that the instruction be adapted to the requirements of country life." The Council are glad to see that, in the new Code since issued by the Board of Education, managers and teachers are given increased freedom in adapting the courses and methods of instruction in their schools to local requirements, and that, in the circular letter to School Managers issued by the Board, recommendations are made as to the teaching in rural schools, which, if carried out, will largely meet the views expressed by this Society.

By order of the Council,

ERNEST CLARKE,

*Secretary.*

13 Hanover Square, London, W.

# AL AGRICULTURAL EXAMINATION BOARD

nted by the Royal Agricultural Society of England  
the Highland and Agricultural Society of Scotland.

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RMAN OF DIRECTORS OF THE HIGHLAND AND AGRICULTURAL  
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SHALL DUGDALE.	MR. JOHN SPIER.
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IN J. SUTTON.	MR. JAMES MACDONALD.

SIR ERNEST CLARKE (*Honorary Secretary*),  
13 Hanover Square, London, W.

## REPORT ON THE RESULTS OF THE FIRST EXAMINATION FOR THE TIONAL DIPLOMA IN AGRICULTURE,

HELD AT LEEDS, APRIL 30 TO MAY 4, 1900.

-Committee to whom was delegated by the National  
Examintion Board the conduct of the first examina-  
by the Board for the National Diploma in the Science  
of Agriculture beg leave to present the following

two National Agricultural Societies (the Royal Agricul-  
ety of England and the Highland and Agricultural  
Scotland) had for a considerable number of years held  
examinations, very similar in character, for a Diploma or  
in Agriculture of their own ; but in 1899 it was agreed  
societies to join forces for the holding annually of a single  
on to take the place of these. Accordingly a National  
ral Examination Board, consisting of representatives of  
ties, was constituted ; and the Regulations and Syllabus of  
nation for the National Diploma in the Science and  
of Agriculture were finally settled by the Board on  
0, 1899, when they were issued forthwith. They are  
o this Report as Appendix A (see p. 363).

2. It was considered desirable by the Board that, with a view to securing thoroughness in the study of the several subjects included in the Syllabus by the candidates for the Diploma, the examination should be spread over two years and be taken in two divisions: Division I. (first year), comprising the subjects of Mensuration and Land Surveying, Agricultural Botany, General Chemistry, Geology, and Agricultural Entomology; and Division II. (second year), the subjects of Practical Agriculture, Agricultural Book-keeping, Agricultural Chemistry, Agricultural Engineering, and Veterinary Science.

3. As the Regulations and Syllabus were not issued until late in the autumn of 1899, it was decided, in order to meet the convenience of competitors who might have been studying for either of the separate examinations of the two Societies now replaced by the new joint examination, that in 1900 candidates for the National Diploma should be allowed as an exceptional privilege to present themselves for both Divisions in the same year. It is to be feared from the result that advantage was taken of this special privilege, not only by candidates who had been properly prepared for the Diploma, but also by a number of other competitors who had not devoted sufficient attention to all the ten subjects of examination to justify their attempting both Divisions, or even Division I.; and the Sub-Committee cannot recommend that the option of taking both Divisions in the same year should be given to candidates for the future.

4. By the courtesy of the authorities of the Yorkshire College at Leeds, the Great Hall of the College was placed at the disposal of the Board on April 30 and four following days for the purposes of the first examination for the Diploma. By the final date fixed for the receipt of applications to sit at the examination (March 31), 53 candidates had entered, and of these no less than 30 asked permission to sit for both Divisions. The result of the examination in the five subjects of Division I. showed, however, that many of these candidates were not sufficiently prepared. Of the 53 who entered, 51 presented themselves; and of these 11 (5 of whom came from one teaching institution) failed to obtain pass marks in every one of the five subjects of examination, 8 failed in four subjects, 6 in three subjects, 7 in two subjects, and 5 failed in one subject: or 37 failures in all.

5. Of the 14 candidates who were successful in Division I., 6 had entered for that Division only and were not therefore further examined this year; 1 candidate who passed in Division I. failed in Division II., and must therefore sit again for the latter Division. The remaining 7 candidates passed in all the subjects of Division II., as well as in Division I., and will therefore be entitled to receive the National Diploma.

6. The Diploma with Honours—in obtaining which only one candidate was successful this year—is to be awarded to candidates who reach a specified standard of marks (higher than the pass

) in each of the ten subjects of examination ; and as a distinction a Gold Medal is offered each year to the best one on the Honours List. As there is only one Honours year, the Gold Medal of the Board for 1900 is awarded to GEORGE POTTS, Durham College of Science, Newcastle-on-Tyne.

The names (in order of merit) of the six other candidates who took part in both Divisions of the examination, and will therefore be entitled to the National Diploma, are :—

ALFRED LAWRENCE SCHNEIDER, South-Eastern Agricultural College, Wye, Kent.

EDWARD WORTHY JAMES THOMPSON, University College of Wales, Aberystwyth.

JOHN ROBERTS, University College of Wales, Aberystwyth.

ALFRED ELD DURANT, South-Eastern Agricultural College, Wye, Kent.

JOHN MEL SIMPSON, Harris Institute, Preston ; and University of Edinburgh.

ALFRED CHRISTOPHER BROWN, Yorkshire College, Leeds.

The names of the seven candidates mentioned in Paragraph 5 of the Regulations, and will therefore be entitled to present themselves for examination next year in Division II., are :—

ALFRED BLORE, University College of Wales, Aberystwyth.

ALFRED WILLIAM BULL, Ramsden, near Billericay, Essex.

ALFRED HENRY JOSEPH FARQUHAR, Durham College of Science, Newcastle-on-Tyne.

ALFRED MONTGOMERIE HATTRICK, West of Scotland Agricultural College, Glasgow.

ALFRED ROBERT WILLIAM OLDERSHAW, Glebe Farm, Costock, Notts.

ALFRED GEORGE WATSON PATERSON, Agricultural College, Aspatria.

ALFRED THOMAS YOUNG, Jun., Newbigging House, Methven, N.B.

It is to be hoped that the Board's first examination be regarded from the point of view of being in the nature of an experiment by the candidates who presented themselves for it, the proportion of successes is not so unsatisfactory as might at first sight appear. It may be doubted that many of the candidates were insufficiently prepared for the thorough and searching examination in the various subjects which it is the wish of the Board to secure ; but it may be an advantage that it should be thoroughly understood that it is the intention of the Board that the National Diploma in Agriculture shall only be awarded to candidates who made themselves familiar with all the subjects included in the

10. The detailed reports of the several Examiners are appended for the information and guidance of the candidates, and of those who may be preparing students for future examinations. The Examination papers themselves are annexed to this Report as Appendix B. As already stated, all the 51 candidates were examined in the five subjects included in Division I., and the reports of the Examiners thereon are as follows :—

**MENSURATION AND LAND SURVEYING. (Maximum, 200 Marks.)**

**Mr. H. Trustram Eve, F.S.I.**

Taken as a whole, the work was good, and showed slight improvement on the examination of last year conducted by the Royal Agricultural Society. Of 51 candidates, 19 (37 per cent.) passed and 32 (or 63 per cent.) failed in this subject.

In common with other examinations, the great fault of the candidates may be said to be that in the large majority of cases they seem quite unable to apply any knowledge they may have gleaned from books, although if the same question be put in the form in which they are accustomed to find it, a correct answer will in all probability be given.

This is better shown by quoting an instance. One of the questions entailed the measurement of thatch on a circular rick. The same candidates who had used a wrong method for this in the written work were quite able to mention in the *vis-à-vis* examination the formula for finding the surface of a cone.

Very cumbrous methods were used by the candidates in Mensuration, and from cross-examination of the students it appeared that they are almost invariably taught the long methods. No attempt seems to be made by the teachers to enlighten them as to "short cuts." One question entailed the multiplication of 31 feet 6 in. by 31 feet 6 in. by 3 feet 5 in. With the exception of two candidates, this was at once reduced to fractions, resulting in a long "sum," whilst if yards had been used the result could almost be obtained without pen or pencil. Some candidates reduced the feet to inches. The ordinary plotting from field notes was well done: candidates expect the question, and are taught accordingly. The first part of the question in levelling was mechanically though well done; but the second part, which required that at least a candidate had made and finished off a horizontal section, was very generally avoided.

Levelling seems to be taught too much in class and not individually. When a pupil has grasped the rudiments of levelling, he should be sent out alone except for a staff man, and told to make a section, and be sent again and again until the "error" was inappreciable. In Question 7 a schedule of a farm was asked to be made, all the facts being assumed. This required no technical knowledge and could have been written in a few minutes; and yet only two candidates attempted the question and the remainder showed no knowledge in the oral examination of the real use of Ordnance maps. Candidates showed a very limited acquaintance with the scales in general use in surveying. They appear, with few exceptions, to have been taught the use of those of one and two chains to the inch and that fitting the Ordnance parish maps; but at this point their knowledge ceased.

**AGRICULTURAL BOTANY. (200 Marks.) Mr. W. Carruthers, F.R.S.**

The examination was on the whole satisfactory, many good papers being received. The majority of the defective answers were given in reply to questions dealing with the science of botany. Practical questions on the

of the farm were as a rule satisfactorily answered, though sometimes specific reasons were unknown, or at any rate not stated. Greater credit should be taken by the teacher of Agricultural Botany to secure for the candidates a thorough acquaintance with the elements of the science of botany, the knowledge of which is the only basis on which intelligent practice in the subject can be based.

#### GENERAL CHEMISTRY. (100 Marks.) Dr. T. W. Drinkwater.

It cannot be said that the candidates were well prepared for the examination, for the majority possessed very little practical knowledge. As to book facts were concerned, some could answer fairly well, but in the case of a practical nature the answers were far from satisfactory. The answers to Question No. 2 had in many cases been learned by heart, and were almost in the words of the book; in the *viva-voce* examination on this question only two or three candidates exhibited any practical knowledge of the subject. Question No. 5 was essentially a practical one and required a common laboratory experiment; but the majority did not even know the nature of the gas given off, and in the method of working the sum showed ignorance in the division of decimals. One candidate returned a value of 100 per cent., and four others gained less than 10 per cent. of the maximum.

#### GEOLOGY. (100 Marks.) Prof. T. Rupert Jones, F.R.S.

The study of Geology in reference to agriculture seems to have been less seriously insisted on and rather better taught than heretofore. The answers to Question No. 9, as to specimens, and the value of the answers to the oral examination, are in most cases high, though not always commensurate to the totals. The frequently poor answers to Question No. 1 show that a knowledge of the mineral constituents of rock-masses has not been well taught. The treatment of Question No. 2 rarely shows a correct appreciation of the value of fossils. The want of a good comprehension of the geological structure of the British Isles is shown by Question No. 3, which was very rarely attempted, although the answers to Question No. 6 show some knowledge of local geology.

#### NATURAL ENTOMOLOGY. (100 Marks.) Prof. J. Arthur Thomson.

It would be well that a line be added to the syllabus to the effect that "a general acquaintance with common insects, worm-parasites, &c., will also be required." So many of the candidates did not know, and did not seem to have been shown, quite common insects, &c., though able to write a good deal about them. Even a bluebottle seemed a novelty, and a tapeworm was called a tapeworm, and so on.

The work of the Examiners in Division II. was made less than at first seemed probable by the large proportion of the candidates entered for the whole examination who failed in Division I., and were not therefore allowed to proceed further. The Examiners' reports in Division II. are appended :—

**PRACTICAL AGRICULTURE.** (Maximum, 500 Marks.) Mr. T. A. Dickson, Mr. James Biggar, and Professor McCracken.

The majority of the candidates acquitted themselves very creditably, although in some cases the practical knowledge was in a measure limited to the district in which the candidate had learned farming. We would recommend that students be urged to acquire greater facility in sketching, so that they may not only be in a better position to illustrate their answers when necessary by intelligible diagrams, but that they may obtain a more definite conception of the construction of machines and farm buildings.

**AGRICULTURAL BOOK-KEEPING.** (200 Marks.) Mr. W. Home Cook, O.A.

The papers show a very creditable knowledge of book-keeping. The papers of three of the candidates were correct in almost every particular, and in nearly every case the papers were worked out in a neat and business-like manner.

**AGRICULTURAL CHEMISTRY.** (200 Marks.) Dr. J. Augustus Voelcker, M.A., F.I.C., and Dr. Bernard Dyer, D.Sc.

In the majority of cases the written questions were well answered, and the candidates showed a good general grasp of the subject. In the oral part of the examination, the recognition of specimens of fertilisers and feeding stuffs was a satisfactory feature, and a good acquaintance was shown with their chemical and physical properties, and with the practical bearings of these in matters concerning the farm.

**AGRICULTURAL ENGINEERING.** (200 Marks.) Mr. R. M. Greaves.

The majority of the candidates appeared to have a good knowledge of the first principles of the subject, but some did not appear to have given sufficient attention to their practical application in existing machinery. In the majority of cases there was a lack of ability in the use of the pencil, most candidates being unable to illustrate their answers by sketches. No candidate explained the action of the common pieces of mechanism mentioned in Question 4. More attention should be paid to drawing, and to the practical application of mechanical principles as exemplified in machines of everyday use in agriculture, such knowledge being indispensable to the proper care and management of all machinery.

**VETERINARY SCIENCE.** (100 Marks.) Professor Sir George Brown, C.B.

In the written as well as the oral examination the answers given to the questions on practical subjects were far more lucid than those which were given to the theoretical questions.

As usual, it was noticed that names were given by the candidates to common things, such as muscle, tendon, ligament, &c., of the ordinary physical characters of which they were absolutely ignorant. It was a revelation to some of them that muscle of the voluntary order was the scientific name for the lean of meat. As a rule, candidates had to admit that they had not seen milk, blood, bone, cartilage, and other common animal structures under the microscope. In these days of lantern lectures such very simple demonstrations ought not to be neglected in the case of candidates who have been prepared for an examination for the National Diploma. It is in these times well recognised by teachers that merely lecturing—i.e. talking to students about anatomy, or, speaking generally, morphology, without giving them an opportunity of actually seeing the parts described—is only a waste of time

thanks of the Board are due to the authorities of the College, Leeds, for their liberality and courtesy in placing Hall of the College at the Board's disposal for the examination; and to Mr. J. E. Compton-Bracebridge, the Director of the Royal Agricultural Society, who very and successfully carried out the somewhat onerous duties incumbent of the Examination.

MORETON (Chairman).  
ERNEST CLARKE.

JOHN GILLESPIE.  
JAMES MACDONALD.

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## APPENDIX A.

### REGULATIONS FOR EXAMINATION IN THE SCIENCE AND PRACTICE OF AGRICULTURE.

*Approved by the National Agricultural Examination Board,  
October 20, 1899.)*

Societies may hold conjointly, under the management of the Agricultural Examination Board appointed by them, an annual examination in the Science and Practice of Agriculture, at a convenient

Candidates who pass the Examination will receive the National Diploma in Agriculture—the Diploma to be distinguished shortly by the letters "N.A.E."

Candidates who obtain not less than a certain percentage of the number of marks in each of the subjects will receive the Diploma with Honours. (*See Regulation 7 below.*) The Diploma with Honours can only be obtained by a Candidate who obtains Honours marks in each Division of the Examination at the first attempt.

A Gold Medal will be awarded to the Candidate on the Honours List who obtains the highest number of total marks in the whole Examination.

The Examination will be conducted by means of written papers and oral examinations. Candidates are requested to note that the marks for the written examination will be allotted in the light of the oral Examination.

The Examination shall be taken in Two Divisions as follows:—

#### *First Division.*

1. Agriculture and Land Surveying.  
2. Agricultural Botany.  
3. Agricultural Chemistry.  
4. Agricultural Entomology.

#### *Second Division.*

5. Practical Agriculture.  
6. Agricultural Book-keeping.  
7. Agricultural Chemistry.  
8. Agricultural Engineering.  
9. Agricultural Veterinary Science.

The maximum number of marks, the minimum number of marks in each subject qualifying for the Diploma, and the minimum number of marks for the Diploma with Honours, are as follows:—

*First Division :—*

SUBJECT.	Max. No. of Marks.	Pass Marks for Diploma.	Marks for Honours.
1. Mensuration and Land Surveying	200	120	150
2. Agricultural Botany . . . .	200	120	150
3. General Chemistry . . . .	100	60	75
4. Geology . . . . .	100	50	60
5. Agricultural Entomology . . .	100	50	60

*Second Division :—*

6. Practical Agriculture . . . .	500	300	375
7. Agricultural Book-keeping . .	200	120	150
8. Agricultural Chemistry . . . .	200	120	150
9. Agricultural Engineering . . .	200	120	150
10. Veterinary Science . . . . .	100	50	60

8. In ordinary circumstances a Candidate shall not be entitled to take both Divisions at one time. A year at least must elapse between the passing of the First Division and sitting for the Second Division; and the Second Division must, except with the special permission of the Board, be taken within two years of the passing of the First Division.\*

\* *This Regulation will not come into force till the year 1901. At the first Examination, to be held in 1900, Candidates may enter for both Divisions.*

9. In special circumstances, the Board may give permission to a Candidate to enter for both Divisions at one time.

10. A Deposit of 1*l*. will be required from each Candidate for each Division. This deposit will be returned to those who obtain Pass marks in all the subjects at that examination. The Board may at their discretion allow a deposit paid by an unsuccessful Candidate to be used for one subsequent Examination in the same Division.

11. A Candidate who fails to obtain Pass marks in any of the subjects in the Division for which he is sitting must take the entire Division again.

12. Holders of both the First Class Certificate of the Royal Agricultural Society of England and the Diploma of the Highland and Agricultural Society of Scotland will not be eligible for this Examination; holders of only one of these distinctions may enter for this Examination in 1900 or 1901.

13. The Board reserve the right to postpone, abandon, or in any way, or at any time, modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.

14. The Examination of 1900 will take place in the Great Hall of the Yorkshire College, LEEDS, on Monday, April 30th, 1900, and five following days. Forms of application for permission to sit at the Examination may be obtained from either of the undersigned, and must be returned duly filled up not later than Saturday, the 31st March, 1900, when the Entries will close.

By order,

ERNEST CLARKE,

*Secretary, Royal Agricultural Society of England,  
13 Hanover Square, London, W.*

JAMES MACDONALD,

*Secretary, Highland and Agricultural Society of Scotland,  
3 George IV. Bridge, Edinburgh.*

# LABUS OF SUBJECTS OF EXAMINATION.

## FIRST DIVISION.

### 1. MENSURATION AND LAND SURVEYING.

Primary rules of superficial and solid mensuration. Volume of a sphere. Applications to practical questions. Estimation of weights of bodies of given dimensions and specific gravity are known.

Surveying by chain. Plotting from field book, and determination of area. The simpler "field problems."

Use and adjustment of instruments employed in Surveying and

Plotting and plotting from field book.

Sufficient knowledge of Trigonometrical Surveying for the determination of heights and distances by Theodolite; as essential to this, solution of triangles by the aid of Logarithmic Tables.

Knowledge of the various classes of maps published by the Ordnance Survey Department and their Scales.

*Each Candidate should have with him at the Examination a pair of compasses of equal parts, including a scale of one chain to an inch, and a straight-edge of the Ordnance map,  $\frac{1}{2500}$ , or 25·344 inches to the mile, a small set square, and a straight-edge about 18 inches in length.*

### 2. AGRICULTURAL BOTANY.

*Botany.*—The structure of plants. The principles of classification. Natural Orders (Phanerogams and Cryptogams) dealing specially with their importance to the Agriculturist.

*Physiology.*—The life of the plant. Organs and their functions—growth and reproductive.

*Pathology.*—Diseases of plants, and their causes. Parasites—Insects, Fungi, Bacteria. Prevention and cure.

*Improvement.*—Conditions in plant life favourable to (a) the improvement of cultivated plants, and (b) the destruction of weeds. New varieties of crops. Pastures. Pruning.

*Candidates will be required to identify plants usually found on a farm.*

### 3. GENERAL CHEMISTRY.

*Chemical Elements.*—Definition and classification of elements. Their properties in nature and leading characters of the elements most commonly

*Common Chemical Compounds.*—Preparation and properties of common compounds of inorganic chemistry (such as the mineral acids, alkalies, salts,

*and Theory.*—The laws of chemical combination. Explanation of chemical action. Distinction of chemical and mechanical compounds. Laws of diffusion. The atmosphere. Theory of combustion.

*Analysis.*—Qualitative and quantitative analysis of atmospheric air. Composition of air required in combustion. Qualitative analysis of common substances. Quantitative analysis in simple cases (such as the determination of strength of solutions, proportions of acids and bases in compounds) by volumetric and gravimetric methods. Ultimate organic compounds by combustion. Proximate analysis by solvents; dialysis and distillation.

5. *Carbon Compounds*.—Ordinary alcohol and ether, and the most common ethylic salts. Oxalic acid, lactic acid, acetic acid and its homologues, fats, glycerine, and soap. Paraffins. Phenol. Cyanogen and its most common compounds, urea, and uric acid. Saccharine and amylaceous compounds. Turpentine and resin. Tannin. Albumen. Gelatine. Fermentation.

*N.B.*—In this section exact knowledge of general principles and typical compounds is expected, rather than diffuse information.

#### 4. GEOLOGY.

1. Chief minerals entering into the composition of rocks. Origin and composition of aqueous and igneous rocks. General principles of the classification of rocks. Leading divisions of the stratified rocks, and their geographical distribution in the British Islands.

2. Stratification, cleavage, and faulting of rocks.

3. Influence of the geological structure of a country on the configuration of the land and the composition of the soil. Relation of Strata to water-supply and drainage. Origin of springs.

4. The various mineral manures, their sources, characters, and mode of occurrence.

5. Different kinds of building-stones and road-materials. Distribution of the various economical substances.

*N.B.*—Candidates will be required to name and describe common rocks, minerals, and fossils.

#### 5. AGRICULTURAL ENTOMOLOGY.

1. The position of Insects in the Animal world, with the characters that mark them out from related animal groups.

2. *General Structure of Insects*.—Head, Thorax, Abdomen, Alimentary Canal, Circulation, Respiratory System, Nervous System and Sense Organs, Reproductive System.

3. *Metamorphosis of Insects*, with the economic importance of the different stages.

4. *Classification of Insects*.—The general characters of the following Natural Orders: Coleoptera, Lepidoptera, Hymenoptera, Diptera, Hemiptera, Orthoptera, Neuroptera.

5. *Larvæ*.—Their varying forms as a help to identification.

6. The *Life-history* of the Insects, Worms, and Acarines injurious to Food Crops generally and to Live Stock. Recognition of the Common pests by external characters and by their work.

7. Insects useful in Agriculture.

8. Circumstances favouring Insect increase. Farm practice in relation to the discouraging of Insect attack.

9. *Preventive and Remedial Measures*.—Encouragement of Insect-eating birds and mammals. Fungoid diseases of Insects. Artificial remedies. Insecticides and their composition and preparation.

*N.B.*—Where the Candidate is not acquainted with the scientific name of an Insect, the generally received English name will be accepted.

## SECOND DIVISION.

### 6. PRACTICAL AGRICULTURE.

*Soils*.—Classification of soils—characters and composition—suitability for cultivation.

*Improvement of Soil*.—Drainage, Irrigation, and Warping. The application of lime—marl—clay—ashes, &c.

*Rotations*.—The principles of rotations—rotations suitable for different climates—systems of farming.

*Manures*.—The properties of manures—general and special—amounts to be applied—period and mode of application—treatment and disposal of

*Food-stuffs*.—The properties of feeding substances—their suitability for different classes of farm stock—considerations affecting their use—rations for different classes of stock.

*Crops*.—Farm crops (cereals, agricultural grasses and clovers, forage crops, and roots). How they grow—their cultivation, including cleaning, sowing, and storage—diseases—insect injuries and remedies.

*Weeds and Parasitic Plants*.—Best methods of eradication.

*Pests of the Farm*.—Injuries to crops and live stock of the farm due to insects, birds, and insects, with their prevention and remedies.

*Weather*.—Meteorology, or the effect of climate on farming conditions.

*Live Stock*.—The breeding, rearing, feeding, and general treatment of different kinds of stock—the different breeds of horses, cattle, sheep, pigs, and poultry—characteristics—the districts where they are generally met with.

*Milk*.—The production and treatment of milk—the manufacture of butter, &c.—the utilisation of bye-products.

*Machinery*.—The uses and prices of the machines and implements employed in farming in different parts of Great Britain.

*Buildings*.—Buildings required on different classes of farms in various districts.

*Farming Capital*.—Calculations of the cost of stocking and working different classes of stock, and dairy farms. Farm valuations. Rent, taxes, and cost of

*It is essential that a Candidate know his subject practically, and be able to satisfy the Examiner of his familiarity with farm routine.*

### 7. AGRICULTURAL BOOK-KEEPING.

*Agricultural Book-keeping*.—Description of books to be kept, with

valuation of stock and effects.

Profit and Loss, and Balance Sheet.

### 8. AGRICULTURAL CHEMISTRY.

*Soils*.—The origin, formation, and classification of soils. The composition of soils. The supply of plant-food by the soil. The chemical and physical properties of soils of different kinds. The adaptation of soils to different crops. The relations of air and water to soils. Nitrification and denitrification of the soil. The chemical and physical effects of tillage operations. Drainage. The improvement of soils. Causes of infertility. Qualitative and chemical analysis of soils.

2. *Plant-life*.—The constituents of plants. The relations of atmosphere, rainfall, heat, and light to vegetation. The sources of plant-food.

3. *Manures*.—The supply of plant-food by manure. The improvement of the soil by manuring. The classification of manures as regards their composition, nature, and use. The manures in general use upon the farm. Farmyard manure and other natural manures. Green-manuring. Liming, marling, claying. Artificial manures, their origin and manufacture. The changes which manures undergo in the soil. The influence of drainage. The application of manures. The analysis of manures. The adulteration of manures.

4. *Crops*.—The composition of the principal farm crops. Characteristics of particular kinds of crops. The influence of climate and season. The manuring of particular crops. The changes that take place in crops during the various stages of their growth. Rotation of crops.

5. *Foods*.—The constituents of foods, and their functions. The nutritive value and digestibility of foods. The chemical composition and use of the principal feeding-stuffs employed on the farm, and the sources of their supply. The main facts regarding respiration and digestion. The relation of foods to the production of work, meat, milk, and manure. The adaptation of foods to special requirements. The residual manurial value of foods, and the circumstances affecting it. The estimation of unexhausted fertility. Analysis and adulteration of foods.

6. *Water*.—Rain-water. Hard and soft waters. Drinking-waters. Irrigation and sewage.

7. *Dairying*.—The composition of milk, and the conditions which influence its quality and supply. Cream and cream-separation. Butter and butter-making. Cheese and cheese-making. The influence of ferments on milk and milk-products. The preservation of milk. Milk-testing.

## 9. AGRICULTURAL ENGINEERING.

1. *Heat*.—Nature of heat; thermometer; absolute zero; specific heat; latent heat; the unit of heat. Total heat of water; as ice, water, and steam. Conduction, convection, and radiation of heat. Mechanical equivalent of heat. Principle of combustion. Quantity of heat generated by combustion. Modes of transforming heat of combustion into power, as in the steam-engine, and gas and oil engine.

2. *Air*.—Properties of air; elasticity, specific heat. Barometer. Moisture. Movement. Winds. Windmills.

3. *Water*.—Composition. Weight. Height of column to balance atmosphere. Flow of water. Friction of water in pipes and channels. Usual speed of flow. Power derived from falls of water. Water-wheels; turbines; water-pressure engines; pumps. Potable water. Sources of supply. Means of purification. Storage.

4. *Mechanics*.—Centre of gravity; stability of structures. The lever; toothed wheels; pulleys and ropes; wrapping connectors; winches; differential pulleys. Laws of motion. Strength of materials, tensile, compressive, torsional, and transverse; elastic limit; ultimate strength. Work; horse-power; animal and human power. Friction of surfaces and axles; lubrication.

5. *Steam-engine*.—Construction of an ordinary portable-engine boiler, of a Cornish boiler, and its setting. Fittings of a boiler. Construction of the stationary and portable steam-engine. Single cylinder. Double cylinder. Compound. Slide-valve. Expansion valve. Cylinder. Piston-rod. Glands. Connecting-rod. Crank and crank shaft. Fly wheel. Bearings. Pet cocks. Lubrication. Steam and fuel consumed per horse-power.

*and Petroleum Engines.*—Principle of action. Construction of r. Sources of loss. Fuel and water required per horse-power.

*Electrical Generators, Motors, and Conductors.*—Principles of action—losses in electrical machinery. Efficiency. Detection of faults. n of shunt and series motors. Use of fuses and cut-outs. Horse-motors, and calculation of Watts to be delivered at terminals. v. Losses in conductors, and calculation of sizes to convey given with definite losses. Jointing and insulation of Conductors.

*Construction of Agricultural Implements.*—The mode of action and the principles involved in the construction of farm implements. The nts of implements for different descriptions of work. Lubrication. or wearing parts.

*Cultivating Implements worked by Steam Power.*

*Horse Cultivating Implements.*—Ploughs. Cultivators or Grubbers. Rollers. Scrubbers, &c.

*Drilling Implements.*—Drills. Manure and water drills. Broadcast Broadcasters. Manure distribntors. Potato planters, &c.

*Hoing Implements.*—Horse-hoes. Scufflers.

*Harvesting of Crops.*—Reaping machines. Mowing machines. Hay-Horse-rakes. Elevators. Silage appliances. Potato raisers, &c.

*Carriages.*—Carts. Waggon. Sleighs. Rick-lifters, &c.

*Preparing Crops for Market.*—Threshing machines. Winnowing. Corn screens. Hummellers. Hay and Straw presses, &c.

*Preparing Foods.*—Mills. Chaff-cutters. Pulpers. Turnip-cutters. akers. Cooking apparatus.

*Dairy Appliances.*—Cream separators. Churns. Butter workers. abs. Curd mills. Cheese presses. Setting-pans. Refrigerators, &c.

*and Improvement.*—Drainage instruments. Limekilns. Arrange-shafting, pulleys, clutches, &c., for farm machinery at homesteads.

*—Marks will be given for neatness and accuracy of Drawing.*

## 10. VETERINARY SCIENCE.

atomy and Physiology, including the comparative anatomy of the the animals of the farm, and the structure and functions of the organs and tissues of the horse, ox, sheep, and pig.

the digestive processes and principles of nutrition in the above

general knowledge of the blood and its circulation, and the processes ation, secretion, and excretion.

the physiology of reproduction, and its bearings on healthy breeding.

the period of gestation in the mare, cow, ewe, and sow, and the management of these animals prior to, at the time of, and after on.

the management of farm stock in health and disease.

## APPENDIX B.

PAPERS SET AT EXAMINATION OF 1900 FOR THE  
NATIONAL DIPLOMA IN THE SCIENCE AND  
PRACTICE OF AGRICULTURE.

## FIRST DIVISION.

## MENSURATION AND LAND SURVEYING.

MAXIMUM MARKS, 200. PASS MARKS FOR DIPLOMA, 120.

(Time allowed, two hours.)

Not more than SIX of the following questions are to be answered. Nos. 3 and 4 must be attempted.

Candidates are required to show the calculations used to arrive at the Answers.

1. (a) Find the *approximate* value of the following circular Haystack:  
Average circumference, 59 ft. 6 in. Average height, 10 ft. 3 in.  
Assume density to be 300 ft. of hay to the ton. Price, 72s. per load.
- (b) Find the cost of carting out manure at 8d. per yard from a farm-yard, with the following data:—  
Dimensions of yard, 31 ft. 6 in. × 31 ft. 6 in.  
Depths of manure, (1) 3 ft. 8 in., (2) 4 ft. 2 in., (3) 3 ft., (4) 2 ft. 9 in., (5) 3 ft. 4 in., (6) 3 ft. 7 in.

2. Measure up the following thatching:—

Stack 1.	Length, 31 ft.	Measurement from eaves to eaves over ridge, 24 ft.
" 2.	" 28 ft.	" 26 ft.
" 3.	" 29 ft.	" 32 ft.
" 4.	" 42 ft.	" 36 ft.
" 5.	" 18 ft.	" 22 ft.

Also on a Circular Stack—Measurement round eaves, 62 ft.; from eaves to apex, 14 ft.

Find the *total* cost of thatching the six stacks at 1s. 2d. per square of 100 ft.

3. From the field notes supplied,<sup>1</sup> lay down the Survey Lines and plot the details given, to a scale of 2 chains to an inch.

Record the lengths of the Check Lines DY. BX. Fb, and Eb.

4. (a) Make up the Level Book given you,<sup>1</sup> filling up the columns headed "Rise," "Fall," "Reduced Levels."

- (b) Draw a longitudinal section of a proposed road 12 chains long, showing—

1. Present surface, introducing (a) a hedge, (b) a brook, (c) a wall.
2. Proposed new surface.
3. 12-inch sewer.
4. 12-inch storm-water drain.
5. Horizontal distances.
6. Reduced levels for present surfaces, and proposed new surface.
7. Assumed facts as to datum.
8. Information as to features on present surface.

Horizontal scale, 2 chains to an inch.

Vertical scale, 10 feet to an inch.

(NOTE.—Marks will not be awarded for mere *correctness* in this question. The facts are *all to be assumed*, and what is required is a properly turned out Longitudinal Section, fit for a client or for deposit with a Local Authority.)

5. You receive instructions from a landowner to set out the field shown in the drawing<sup>1</sup> in six portions, as follows:—

<sup>1</sup> Not here reproduced.

- are to be 3 pieces each side of field roadway. The 2 pieces abutting Public Road are to contain 3 acres each exactly. The 2 centre pieces each side of the field roadway are to contain two acres each.
- you are required to show :—(a) the necessary division lines to contain the required areas, and (b) to ascertain the area of the two portions at the rear of the field.
- State three cases where a Theodolite or other angular instrument *must* be used in making a plan, giving short reasons.
- Describe the method of mapping a quadrilateral field with a Theodolite, and, in connection with this, state on a sketch of any field which lines *must* be chained to enable you to properly plot the field.
- you are required to make a schedule of a farm from the Ordnance Map. Procured the necessary sheets, describe in detail exactly what you do.
- Write out the schedule in proper form, assuming there are twelve fields, besides the house, garden, and homestead. In what respect do the result differ from the true area of the Farm?
- Describe shortly the optical square, and state its use.
- What is a Bench Mark?
- You find a Bench Mark on the wall of a house 2 ft.  $1\frac{1}{2}$  in. above the pavement. Where would you put the bottom of the Level Staff if the reading of the Bench Mark is required?
- What is generally considered as the limit in length of offsets in field surveying?
- In a Survey, how would you chain from one station to another, assuming neither was visible from the other owing to the line going over a hill?
- A Base line on a Survey is interrupted by a Farm Homestead. How would you overcome the difficulty?
- An Agricultural Field is required to be drained. How would you ascertain the place for the main outfall and the general direction of the subsidiary drains?

#### AGRICULTURAL BOTANY.

MAXIMUM MARKS, 200. PASS MARKS FOR DIPLOMA, 120.

(Time allowed, two hours.)

Not more than SIX of the following questions are to be answered.  
Nos. 6 and 8 must be attempted.

- Explain the position and functions of cambium, apical tissue, and
- describe the processes by which the food stored in a grain of wheat is available to the growing embryo.
- Explain the structure and function of the leaf.
- What are the differences between an angiosperm and a gymnosperm, a
- and an epiphyte? Give examples of each.
- Give the life-history of the plant that causes rust in wheat.
- State the principal characters of the Natural Order Leguminosæ. Give
- names of some plants in this Order that are cultivated, and others that are useless or injurious.
- Explain the methods that have been employed to obtain improved
- of cultivated plants.
- What ends should be employed in laying down land to permanent
- Give the reasons for your selection. What grasses should be rejected
- purpose, and why would you reject them?
- What are the sources of the plant's supplies of carbon, oxygen, hydro-
- phorus, and calcium? Specify the benefit the plant derives from
- manure and from basic slag.

## GENERAL CHEMISTRY.

MAXIMUM MARKS, 100. PASS MARKS FOR DIPLOMA, 60.

(Time allowed, two hours.)

Not more than SIX of the following questions are to be answered.  
Nos. 5 and 9 must be attempted.

1. How is sodium hydrate prepared from sodium carbonate? What is the action of aqueous sodium hydrate on the following: (a) zinc, (b) phosphorus, (c) bromine?
  2. What relationship is there between the specific heat of an element and its atomic weight? Whose law relates to this?
  3. How would you prepare pure sulphuretted hydrogen? What is the action of sulphuretted hydrogen on neutral aqueous solutions of the following: (a) ferric chloride, (b) ferrous sulphate, (c) zinc sulphate, (d) arsenic oxide ( $As_2O_3$ )?
  4. Urea—how is it prepared artificially? To what group of bodies does it belong? What is the action on it of (a) nitrous acid, (b) sodium hypobromite?
  5. One hundred cubic centimetres of a solution of potassic nitrate are boiled with ferrous sulphate and sulphuric acid. What action takes place? The gas given off is collected, and measures at normal temperature and pressure 12.4 c.c. How much potassic nitrate was in the solution?
  6. How is iodide of methyl prepared? What is the action of ammonia upon iodide of methyl?
  7. What is the action of heat on the following: (a) ammonium nitrate, (b) ammonium nitrite, (c) calcic acetate, (d) ammonium phosphate, (e) a mixture of sodic acetate and sodic hydrate?
  8. Describe in detail, step by step, the method you would adopt to demonstrate the presence of silica in a feldspar.
  9. How is aldehyde prepared from common alcohol? What is the action on aldehyde of (a) chlorine, (b) mercuric oxide, (c) phosphoric chloride?
- K = 39, N = 14, O = 16, Fe = 56, S = 32; 22.33 litres of hydrogen at n. t. and p. weigh two grammes.

## GEOLOGY.

MAXIMUM MARKS, 100. PASS MARKS FOR DIPLOMA, 50.

(Time allowed, two hours.)

Not more than SIX of the following questions are to be answered, of which No. 9 must be one.

1. Enumerate the chief kinds of *sedimentary*, *metamorphic*, and *igneous* rocks respectively; and indicate the most important of the *constituent minerals* of the rocks you mention.
2. What is a Fossil? Why are Fossils of use to a Geologist? What conclusions would he arrive at if he found either Ammonites, Goniatites, Graptolites, Nummulites, or Turrilites as the predominating fossils at places under his examination?
3. Compare and explain the physical features and the geological structure of the *West and the East of Scotland*, and of *Wales and the East of England*. Give illustrative diagrams with your answer.

explain the processes in the disintegration of *limestone* and *granite* solely by atmospheric agency; and indicate the results in each case.

Draw the section of a hill one slope of which cuts the outcrops of beds of clay and sand at a low angle; and explain how the natural conditions would affect—(1) the fields occupying the hill-side; (2) a road up the hill; (3) a deep cutting along that road, made for laying large pipes to a town at the foot of the hill.

Mention some of the best districts you know of for Sheep-walks, Grass-fields and Corn-fields: and give the geological reasons for their existence as such.

What are the chief Mineral Manures? Of what are they composed? For what are they prepared for use? Where and from what Geological Formations are the natural materials obtained?

What are the best Building Stones and Road Materials? Give particulars of the constitution, place of occurrence, and geological age of those materials.

Name and describe *four* of the specimens on the table.

### AGRICULTURAL ENTOMOLOGY.

MAXIMUM MARKS, 100. PASS MARKS FOR DIPLOMA, 50.

(Time allowed, two hours.)

Answer more than SIX of the following questions are to be answered, of which either No. 8 or No. 9 must be one. The SIX questions attempted may, if desired, include both 8 and 9.

State the most important distinctions between an insect and a spider.

Draw a diagram representing a cross section through the mesothorax of a typical insect, and name the parts.

Describe what occurs in a blue-bottle (or some similar fly) between the larval period and the emergence of the imago.

State the general characters of the order Orthoptera, and classify the following insects:—Green-fly (*Aphis*), Crane-fly (*Tipula oleracea*), Dragon-fly (*Zygoptera*), Sawflies (*Tenthredinidae*), and Turnip-fly (*Phyllotreta nemorum*).

Give an account of the external characters of a caterpillar, and make a list of the larval forms of a drone-fly (*Eristalis*), a house-fly (*Musca domestica*), a mosquito (*Culex*), a bee, and a ground-beetle.

Describe the life-history of the warble-fly (*Hypoderma bovis*), or of the root-miner (*Cecidomyia destructor*); and state the causes of the following conditions: liver-rot in sheep; staggers or sturdie in sheep; gapes in poultry; bots in horses; and measy pork.

Make notes on the agricultural utility of humble-bees, ladybirds, and hover-flies; and state the causes of American blight, "gout" in barley, and "frost" in carrots.

Explain how you would deal with broken-up pasture-land seen to be infested with wire-worm.

Discuss preventive and remedial measures which may be taken against the losses of the turnip sawfly.

**SECOND DIVISION.****PRACTICAL AGRICULTURE.****MAXIMUM MARKS, 500. PASS MARKS FOR DIPLOMA, 300.***(Time allowed, three hours.)*

**Not more than NINE of the following questions are to be answered.  
Nos. 2, 6, and 10 must be attempted.**

1. What are the general principles underlying rotations? State what modifications the changed conditions of Agriculture have caused in the rotations of (a) Strong Land, (b) Light Land.

2. Give the names of the principal corn and root crops grown in England, with particulars as to:—

- (a) The ordinary season of sowing.
- (b) The quantity of seed usually sown per acre.
- (c) The crop ordinarily produced per acre under good management.
- (d) The soils most favourable for their growth.

3. What breed of Sheep would you prefer to keep on a farm of 300 acres, half arable, half pasture, in the Midlands? Give reasons for your preference. State the number in your opinion such a farm should carry. How would you manage the lambs from the time they were weaned till they were sold fat in the following spring? Give the weight per head of carcass, and the money you would expect to realise when sold.

4. Describe in detail and show by sketch how you would proceed to drain a field 400 yards long by 200 yards broad. There is an open watercourse running along the longer side; there is a fall of three feet in the breadth of the field. The soil is stiff clay. Give size of pipes you would employ, state depth and distance apart of drains, and give detailed calculation of the probable cost.

5. On a farm of 250 acres arable, in rotation, 50 acres permanent pasture and meadow, how would you manage a Dairy of, say, 50 cows? What summer and winter keep would you allow them from the farm? What extra food, if any, would you buy, and in what form would you dispose of your Dairy produce?

6. Give the analysis and approximate price of Sulphate of Ammonia, Nitrate of Soda, Pure Vitriolated Bones, Bone Meal, Kainit, Basic Slag, and Superphosphate. What quantities of the above would you use for Hay, Grain, and Root crops?

7. Give details of the growing, harvesting, and marketing of a crop of Oats of, say, 7 quarters per acre. Take the straw at  $1\frac{1}{2}$  times the weight of grain, and make out a Dr. and Cr. Account for the Crop. Rent and Taxes, 30s. per acre.

8. Give the points of a proper stamp of horse for Agricultural purposes, and give the defects of conformation you would seek to avoid in making a selection.

9. What are your views as to the best method of treating and using farmyard manure in the neighbourhood in which you have learned farming? State what you know of the customs prevalent in different parts of the country with respect to the management of farmyard manure, the condition in which it is used, the crops to which it is applied, and the time and manner of its application. Suggest reasons for the differences of practice you have mentioned. How would you regulate the application of, say, 100 tons of manure to ten acres of meadow so that each acre should receive approximately ten tons?

10. What machines and appliances would you require to prepare food for the live stock of a 300-acre dairy farm (two-thirds pasture and one-third tillage), and what should they cost individually? Show by drawings how you would arrange the machines enumerated. Explain how you would distribute the food to the different parts of the steading. Prepare a timetable showing the hours at which the live stock would receive their various

and state what those rations would consist of in the case of cows in and horses in full work, in the month of March.  
 Give a short life-history of a Shorthorn Steer, calved in April 1898, to the butcher in April 1900, giving particulars of feeding and treating the various stages of its growth, and adding a detailed statement of keeping it during the last week of January 1900. What should its average daily increase be? At the time of slaughter what (a) its live weight, and price per hundredweight; (b) its dead weight, per pound? State the price of beef at the present time in the various parts of the United Kingdom.  
 Name the most troublesome weeds of arable land and of pastures. Describe the habit of growth of each of the plants you name, and explain the cheapest and most effective method of dealing with it.

### AGRICULTURAL BOOK-KEEPING.

MAXIMUM MARKS, 200. PASS MARKS FOR DIPLOMA, 120.

(Time allowed, two hours.)

The following is the Trial Balance at Michaelmas (September 29) of the year 1900, by Andrew Thomson, Farmer.

	Dr.			Cr.		
	£	s.	d.	£	s.	d.
Capital a/c				2,100	0	0
Rate a/c	200	0	0			
Bank	150	0	0			
House	10	0	0			
Wages a/c	110	0	0			
Dep a/c	380	0	0			
Stock a/c	320	0	0			
Salaries a/c	50	0	0			
Insurance a/c	20	0	0			
Tools and Manure	75	0	0			
Reparations, &c.	200	0	0			
Feeding Stuffs	30	0	0			
Seeds, Seed Merchant				150	0	0
Rees, Implement Maker				70	0	0
Watson	15	0	0			
Wilson, Corn Merchant	430	0	0			
Brown, Cattle Dealer				184	0	0
Interest	125	0	0			
Rent, Taxes, and Insurance	33	0	0			
Repairs	20	0	0			
Miscellaneous Expenses	46	0	0			
Profit	290	0	0			
	<u>£2,504</u>	<u>0</u>	<u>0</u>	<u>£2,504</u>	<u>0</u>	<u>0</u>

Transfer the ledger Accounts with these balances, and make the necessary ledger for the Stock on hand at the closing date, which Stock was as follows:—

Stock:—

5 at 20*l.* each.

Dep:—

175 Leicester breeding ewes at 32*s.*

86 Leicester draft ewes and gimmers at 30*s.*

263 Leicester hogs at 20*s.*

Stock:—

1 bull at 25*l.*

6 cows at 13*l.*

17 calves at 6*l.*

40 yearlings at 10*l.*

Figs :—

60 at 25s.

Corn :—

40 acres wheat,  $3\frac{1}{2}$  qrs. per acre, at 30s.

50 acres barley,  $4\frac{1}{2}$  qrs. per acre, at 20s.

Seeds and manure, valued at 40l.

Implements, &c., according to the Ledger value stand at 200l. Write off 10 per cent. for depreciation.

Allow for accrued rent at 250l. per annum since Lady Day (March 25) last.

Prepare a Profit and Loss Account and Balance Sheet.

2. What books would you advise Andrew Thomson to keep? Give a short description of them and explain their uses.

### AGRICULTURAL CHEMISTRY.

MAXIMUM MARKS, 200. PASS MARKS FOR DIPLOMA, 120.

(Time allowed, two hours.)

Not more than SIX of the following questions are to be answered.

Nos. 3, 7, and 8 must be attempted.

1. Give examples showing how the composition of a soil will affect its suitability for the growth of particular crops.

2. Give instances of the variable application and meaning of the term "availability" in the case of soil, manures, and feeding stuffs respectively.

3. Which are the principal carbohydrates found in plants? Describe their sources and the conditions that determine their formation. What are the chief chemical differences between them?

4. For what purposes is domestic soot used in agriculture, and to what does it probably owe its value? What is the composition of a good sample of soot, and what causes may lead to variation of quality or inferiority of samples?

5. Give examples showing that, as apart from the chemical composition, the condition of a manure, as also of a feeding stuff, may have an important bearing upon its value and utility.

6. The practical manurial requirements of different plants are not necessarily indicated by the relative quantities of the various manurial constituents assimilated by them and found in them when mature. Indicate briefly how wheat, clover, turnips, and mangels, as grown in ordinary rotation, differ from one another in their practical demands for (a) nitrogenous manure, (b) phosphatic manure.

7. For what reasons, and under what circumstances, is it advantageous to the farmer to have at his disposal feeding stuffs rich in albuminoids? Arrange the following in the order of their relative richness in albuminoids: barley, beans, bran, cotton cake (undecorticated), cotton cake (decorticated), dried grains, earth-nut (or ground-nut) cake, linseed cake, maize, oats, peas, rice meal.

8. The "manurial value" of purchased foods has sometimes been overestimated through dependence on purely theoretical calculations. Give any practical reasons for the non-realisation in crop returns of anything like the full "theoretical" manurial value of feeding stuffs, and state under what conditions the farmer is most likely to obtain the nearest approximation to the full value.

9. Give the percentages of fat and non-fatty solids present in milk of good average quality, and indicate the approximate quantitative composition of the non-fatty solids as regards proteids, milk-sugar, and ash. What general limitations would you give as to the extent to which the quality of milk is likely to be affected by variable feeding?

# AGRICULTURAL ENGINEERING.

MAXIMUM MARKS, 200. PASS MARKS FOR DIPLOMA, 120.

(Time allowed, two hours.)

more than SIX of the following questions are to be answered.

1. Define a Horse-Power. What is the horse-power of a double-acting steam crank is 6 inches, diameter of cylinder 8 inches, making 150 revolutions per minute? Average steam pressure, 20 lb. per square inch.

2. What is meant by a British Thermal unit, and what is its mechanical equivalent?

3. Describe any method by which this relation has been determined. How many hundred yards from a farm building and at a lower level there is a shaft of 20 feet, over which pass 150 cubic feet of water per minute.

4. What is the theoretical horse-power? How would you propose to make the shaft available and transmit it to the building for the purpose of driving a water-wheel? Illustrate your answer by sketches.

5. Explain, with sketches, the action of the following: Friction Clutch, Centrifugal Governor, Steam Pressure Gauge, Reversing Gear of Chaff-cutter.

6. Explain clearly why pulleys carrying belts are made slightly convex. How is motion transmitted from one shaft to another at right angles in a belt drive by means of a belt. Show how the pulleys should be arranged for the direction of rotation. What would happen if the motion were reversed?

7. Describe any form of oil engine you are acquainted with, with special reference to the method of governing and firing the charge.

8. Explain how an electric current is produced in a dynamo. What do you understand by the terms Ampère, Volt, Ohm, Watt, and how are they measured?

9. Explain the difference between "Indicated Horse-Power" and "Brake Horse-Power," and show how each is ascertained.

10. In choosing suitable material at hand, describe the process of making a road to carry heavy loads. Draw a section showing the materials you use, drainage, and contour of surface.

# VETERINARY SCIENCE.

MAXIMUM MARKS, 100. PASS MARKS FOR DIPLOMA, 50.

(Time allowed, two hours.)

more than SIX of the following questions are to be answered.

Nos. 1, 2, 4, and 7 must be attempted.

1. State the most prominent variations in the bones of the skeleton of the horse with the other animals of the farm.

2. Describe the several structures which contribute to the formation of the head and its appendages.

3. Compare the digestive organs of the horse with those of cattle, sheep, and swine.

4. Fully trace the course of a portion of food from the mouth to the rectum in the several animals mentioned.

5. Explain the changes which take place during the passage of food through the alimentary canal.

6. Describe the composition of the blood, chemical and physical, and trace its course from and back to the left ventricle of the heart.

7. What recognised principles should be kept in view in selecting animals for different purposes?

8. What is the average period of gestation in the mare, cow, ewe, and sow, and what precautions are necessary prior to, at the time of, and after parturition?

9. In general terms what sanitary measures are essential for the maintenance of the health of farm stock.

## Notes, Communications, and Reviews.

### EXPERIMENTS ON LUCERNE.

IN a recent number of the Journal<sup>1</sup> Dr. Voelcker gives an account of some experiments at Woburn on the manuring of lucerne. The crop was sown in 1889 on a strip of land which had become "clover sick" through frequent repetition of clover. Sundry plots were marked out, and manured every year, each in a particular way. For seven years the manures produced no conspicuous results, but since 1896 they have told in some cases heavily.

Phosphates alone have been of no value. Nitrate of soda alone has produced a fairly good increase, though sulphate of ammonia alone has not done well. Sulphate of potash used by itself has produced a good increase; but by far the best results have been obtained on the plots on which both phosphates and sulphate of potash have been mixed with 2 cwt. of either nitrate of soda or sulphate of ammonia per acre. The use of these mixed dressings has, in round numbers, given an increase of green fodder (over the yield of the unmanured plot) amounting to from 7 to 9 tons per acre in 1897, and to from 7 to 7½ tons in 1898.

Unfortunately, the combination of phosphates and potash was not tried *without* the addition of either nitrate of soda or sulphate of ammonia, and this leaves us in doubt as to how far the high results were due to the combination of "minerals" and how far they were influenced by the nitrogen. The fact that the manures produced for so long no conspicuous results may possibly be due to some extent to the store of nitrogen previously accumulated in the soil by the continuous growth of clover.

The discovery of the symbiotic organisms in the root nodules of the *Leguminosæ*, and of the fact that through their agency the host plants are rendered potentially independent of combined soil nitrogen, has been so much discussed during the last few years that we are apt sometimes to forget that, in practical farming, leguminous crops do not wholly live, so to speak, upon their nitrogenous "independence." That they can and do take up and

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<sup>1</sup> Journal R.A.S.E., 3rd series, vol. x. part iv. 1899 (p. 603).

ate combined nitrogen in the form of nitrates, if not also in forms, has been abundantly proved at Rothamsted and else-

For the practical farmer the question is one as to how far and such a leguminous crop can be left to rely upon its own nitrogen-getting resources, coupled with the naturally produced soil and the manurial nitrogen residues left unappropriated by other crops; or how far it may be wise to manure it directly with nitrogenous manure.

In ordinary rotations, when we deal with leguminous crops of one or two years' growth, it seems probable that, when land is farmed and in good condition, special nitrogenous manures are best economically bestowed on the non-leguminous crops; but in the case of lucerne, which is a perennial crop, the years of whose life on a favourable soil are, in practice, terminated usually by the gradual invasion and competition of naturally sown grasses and weeds, the matter is different. Lucerne, or "Alfalfa," as it is called, is very largely grown in Spain, and on the South American continent; and both in Spain and in South America the use of soda is said to be profitably used in its cultivation.

It happens that, with the assistance of my friend Mr. Shrivell, of Ten Green, Hadlow, near Tonbridge, I have during the last few years been carrying out an experiment with lucerne on lines that are similar to those of the Woburn experiments described by Mr. Belcher. The results show very strikingly that, leguminous though it is, lucerne is capable of being economically influenced by the application of nitrogenous manure, used with phosphates and potash salts—far more so than by the liberal application of phosphates and potash salts together without nitrogen.

A lucerne patch was sown in the spring of 1897, being marked out into four plots each  $\frac{1}{16}$  of an acre in area, namely, X, A, B and D. The soil is a poor clay loam, of light colour, naturally deficient in lime and having a clay subsoil. Before the crop was sown the soil was limed at the rate of 1 cwt. of lime per plot, or 5 tons per acre. Although the soil is by no means a typical lucerne soil, the crop under the treatment adopted, has taken kindly to it and is now in its fourth year, still doing well. Phosphatic manure and potash have been applied to each of the four plots, as follows:—

#### *Manure per Acre.*

- |   |   |   |                                                  |
|---|---|---|--------------------------------------------------|
| 7 | . | . | Basic slag 7 cwt.; kainit 4 cwt.                 |
| 8 | . | . | Superphosphate 4 cwt.; sulphate of potash 1 cwt. |
| 9 | . | . | Superphosphate 3 cwt.; sulphate of potash 1 cwt. |

Plot X has received only the mineral manures, but the other three plots have received nitrate of soda as well, at the respective rates of 1 cwt., 2 cwt., and 4 cwt. per acre. In the first year the nitrate of soda was applied on June 25, in the second year on May 1, and in the third year on February 7.

Two cuttings were obtained in the first year, but there were four cuttings in each of the second and third years. The

following table gives the mode of manuring and the total quantity of green fodder cut in the three years, separately and collectively :

*Green Fodder cut per Acre.*

Plot	Manure per acre	1897 (1st year)	1898 2 <sup>nd</sup> year	1899 (3rd year)	Total in 3 years	Total gain due to the addition of nitrate of soda in 3 years
		t. c.	t. c.	t. c.	t. c.	t. c.
X	{ Phosphates and potash salts only }	3 1	11 16	14 14	29 11	—
A	{ Phosphates, potash salts, and 1 cwt. nitrate of soda }	2 19	13 11	19 15	36 5	6 14
B	{ Phosphates, potash salts, and 2 cwt. nitrate of soda }	3 10	14 13	21 5	39 8	9 17
D	{ Phosphates, potash salts, and 4 cwt. nitrate of soda }	3 17	13 4	17 16	34 17	5 6

If the yield of plot x, receiving mineral manures only, be deducted, the increase obtained by the use of nitrate of soda on plots A, B and D in the second and third years (when the plant was established) was as follows :

*Increase in Green Fodder per Acre due to supplementing Phosphates and Potash Salts with Nitrate of Soda.*

Plot	Manure per acre	1898	1899	Both years
		t. c.	t. c.	t. c.
A	1 cwt. nitrate of soda . . . .	1 15	5 1	6 16
B	2 " " " " . . . .	2 17	6 11	9 8
D	4 " " " " . . . .	1 8	3 2	4 10

It is clear, therefore, that although lucerne belongs to the *Leguminosae*, which are capable of dispensing with an artificial supply of nitrogen, it is nevertheless under some circumstances very grateful for a supply of nitrogenous manure. It will be seen that in every year 2 cwt. of nitrate of soda per acre gave better results than 1 cwt., but that the still larger dressing of 4 cwt. per acre has, for some undiscovered reason, given less advantage than even 1 cwt. per acre.

The increase on plots A and B was obtained at an expense satisfactorily remunerative to the grower.

The green fodder was in all cases cut at the same time and under the same conditions on all the plots, and directly it was cut it was weighed, without being carted, by means of a weighing machine kept in a shed within a few yards of the plots ; so the weights of green fodder are strictly comparable. No analyses, however have been made of the fodder, and therefore no comparisons

can be made between the relative feeding properties of the fodder from the different plots. Whatever variation there may have been would probably be in favour of the more heavily yielding plots, the produce of which was more succulent and less stalky, and presumably more nutritious, than that of the others. But for practical purposes it may be assumed that none of the fodder would be valued by a farmer at less than 10s. a ton in its green state.

On this valuation, and taking nitrate of soda at 10s. per cwt. (which includes the cost of carriage, cartage, labour of sowing, &c.), we find the profit due to its use in the two years after the plant became well established to be as follows :

Plot	Nitrate of soda used per annum in addition to phosphates and potash salts	Increase per acre in green fodder in 2 years, as against phosphates and potash salts only	Value of increase in fodder per acre at 10s. per ton	Cost of nitrate of soda used in the 2 years per acre	Profit per acre due to the use of nitrate over 2 years
A	1 cwt. per acre	t. c. 6 16	£ s. d. 3 7 6	£ s. d. 1 0 0	£ s. d. 2 7 6
B	2 cwt. per acre	9 8	4 14 0	2 0 0	2 14 0

The experiment is being continued, the lucerne crop being, of course, a perennial one.

It should be mentioned that, as is usual in plot experimental work, the crop is kept clean, and so the lucerne is free from the natural competition of adventitious weeds and grasses. It follows that the secondary—but by no means unimportant—effect of the manures on this competition, as affecting the possible comparative duration of the lucerne crop on the different plots, is in the case of these trials necessarily eliminated.

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## CROPS AND LIVE-STOCK IN 1899.

PRELIMINARY instalments of the agricultural returns for the year 1899 have appeared in tabular form in the Journal, at pp. 582 and 786 of last year's volume (1899), and at p. 182 of this volume (Part I.). These, with other details, are embodied in the summary table given herewith at pp. 382 and 383 which is compiled from the complete returns<sup>1</sup> that were published on June 2, 1900. This table may be consulted in conjunction with the following observations derived from Major Craigie's report prefixed to the official volume.

<sup>1</sup> *Agricultural Returns for Great Britain, showing the Acreage and Produce of Crops, Prices of Corn, and Number of Live Stock, with Agricultural Statistics for the United Kingdom, British Possessions, and Foreign Countries, 1899.* [Cd. 166], pp. xlii. 258. London: Eyre & Spottiswoode. 1s. 4d.

*Estimated Total Produce and Yield per Acre of the Principal Crops,  
Cattle, Sheep, and Pigs, in the United Kingdom*

[Compiled from the Returns for 1899]

Crops	England						Wales					
	Acreage, 'thousands' (000) omitted		Produce of crops, 'thous- ands' (000) omitted		Average yield per acre		Acreage, 'thousands' (000) omitted		Produce of crops, 'thous- ands' (000) omitted		Average yield per acre	
	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899
<b>CORN CROPS :—</b>	Acres	Acres	Bush.	Bush.	Bush.	Bush.	Acres	Acres	Bush.	Bush.	Bush.	Bush.
Wheat . . . . .	1,987	1,900	69,074	62,380	34.76	32.83	59	54	1,582	1,381	26.53	24.02
Barley, including Bere . . . . .	1,563	1,636	55,378	56,164	35.44	34.34	103	106	3,377	3,328	32.82	31.40
Oats . . . . .	1,731	1,782	75,263	73,905	43.49	41.48	231	220	8,390	7,528	36.37	34.20
Beans . . . . .	217	234	6,692	7,005	30.83	29.90	1	1	36	37	28.25	27.00
Peas . . . . .	173	160	4,782	4,359	27.69	27.31	2	2	34	35	21.67	21.25
<b>TOTAL CORN CROPS (including Rye)</b>	5,731	5,756	—	—	—	—	397	385	—	—	—	—
<b>GREEN CROPS :—</b>			Tons	Tons	Tons	Tons			Tons	Tons	Tons	Tons
Potatoes . . . . .	365	388	2,256	2,254	6.17	5.81	23	23	184	173	5.62	5.20
Turnips, including Swedes . . . . .	1,237	1,204	13,083	9,574	10.58	7.95	68	67	1,011	734	14.84	10.96
Mangel . . . . .	243	263	6,064	6,378	17.68	17.56	8	8	129	130	16.29	16.30
Cabbage, Kohl-rabi, and Rape . . . . .	150	156	—	—	—	—	3	4	—	—	—	—
Vetches or Tares . . . . .	182	175	—	—	—	—	2	2	—	—	—	—
Other Green Crops . . . . .	121	124	—	—	—	—	1	1	—	—	—	—
<b>TOTAL GREEN CROPS</b>	2,399	2,410	—	—	—	—	115	115	—	—	—	—
<b>OTHER CROPS, GRASS, &amp;c. :—</b>			Cwt.	Cwt.	Cwt.	Cwt.			Cwt.	Cwt.		
Clover and artificial grasses and permanent pasture . . . . .	10,465	10,754	—	—	—	—	1,630	1,659	—	—	—	—
Ditto for hay . . . . .	5,712	5,376	178,334	131,758	—	—	674	655	16,674	13,081	—	—
Flax . . . . .	1	1	—	—	—	—	—	—	—	—	—	—
Hops . . . . .	50	52	357	661	7.17	12.76	—	—	—	—	—	—
Small Fruit . . . . .	63	65	—	—	—	—	1	1	—	—	—	—
<b>TOTAL OTHER CROPS.</b>	16,291	16,247	—	—	—	—	2,305	2,315	—	—	—	—
<b>Live Stock</b>	Year 1898		Year 1899		Year 1898		Year 1899					
	Actual No.		Actual No.		Actual No.		Actual No.					
Horses . . . . .	1,163,625		1,163,813		161,964		163,874					
Cattle . . . . .	4,674,303		4,841,852		701,777		736,001					
Sheep . . . . .	15,886,538		16,261,417		2,268,708		2,416,337					
Pigs . . . . .	2,078,898		2,225,420		228,481		258,114					

NOTE.—The produce of Corn Crops for Ireland, originally returned in weight, has been converted into bush the rate of 60 lb. to the bushel of Wheat; 50 lb. to the bushel of Barley; 39 lb. to the bushel of Oats; and 60 lb. to the bushel of Beans and Peas.

Also the Acreage under Other Crops and Grass, and Numbers of Horses,  
and in the Years 1898 and 1899.

[Agricultural Returns.]

Scotland					Ireland						United Kingdom*					
Acreage, 'thousands' '000 omitted	Produce of crops, 'thou- sands' (000) omitted		Average yield per acre		Acreage, 'thousands' '000 omitted		Produce of crops, 'thou- sands' (000) omitted		Average yield per acre		Acreage, 'thousands' '000 omitted		Produce of crops, 'thou- sands' (000) omitted		Average yield per acre	
1898	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899	1898	1899
Acres	Bush.	Bush.	Bush.	Bush.	Acres	Acres	Bush.	Bush.	Bush.	Bush.	Acres	Acres	Bush.	Bush.	Bush.	Bush.
47	2,372	1,768	42'47	37'42	53	52	1,866	1,731	35'16	33'38	2,158	2,055	74,868	67,361	34'75	33'76
240	2,297	8,213	39'07	34'10	158	170	6,679	6,817	42'23	40'17	2,069	2,169	74,781	74,532	36'26	34'64
958	35,248	32,313	36'87	34'78	1,165	1,136	53,557	51,393	46'04	45'26	4,098	4,110	172,578	166,140	42'27	40'57
13	471	440	35'26	33'66	2	2	67	85	38'92	42'63	234	251	7,267	7,566	31'13	30'19
1	22	27	25'47	24'04	1	1	9	10	21'84	23'95	177	163	4,868	4,431	27'00	27'23
1,367	—	—	—	—	1,391	1,372	—	—	—	—	8,817	8,804	—	—	—	—
137	842	649	6'68	5'11	665	663	2,942	2,760	4'43	4'16	1,201	1,228	6,225	5,837	5'23	4'82
470	7,242	5,752	15'50	12'23	807	801	5,163	4,309	16'82	14'29	2,087	2,050	26,499	20,370	12'74	9'97
2	26	30	18'04	16'87	56	63	1,010	1,066	18'04	17'00	409	437	7,228	7,604	17'71	17'41
13	—	—	—	—	49	46	—	—	—	—	215	219	—	—	—	—
10	—	—	—	—	3	4	—	—	—	—	197	190	—	—	—	—
2	—	—	—	—	25	25	—	—	—	—	151	155	—	—	—	—
624	—	—	—	—	1,105	1,102	—	—	—	—	4,261	4,274	—	—	—	—
2,671	—	—	—	—	10,470	10,575	—	—	—	—	25,077	25,515	—	—	—	—
522	17,752	15,609	—	—	2,174	2,118	105,552	97,516	—	—	2,113	2,692	218,313	257,964	—	—
—	—	—	—	—	24	35	—	—	—	—	35	35	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	50	52	287	661	7'17	12'7
6	—	—	—	—	—	—	—	—	—	—	70	72	—	—	—	—
1,369	—	—	—	—	12,678	12,728	—	—	—	—	34,345	34,366	—	—	—	—
Year 1898	Year 1899				Year 1898				Year 1899				Year 1898			
Actual No.	Actual No.				Actual No.				Actual No.				Actual No.			
281,551	196,944				512,788				501,982				2,040,330			
194,224	1,217,177				4,486,242				4,507,272				11,142,212			
167,948	7,560,980				4,287,274				4,264,076				21,102,389			
124,116	140,229				1,262,682				1,262,311				2,719,219			

\* Including Barfoot.

\* Cabbage and rape only.

\* Gooseberries, strawberries, currants, and other small fruit.

\* Including (under Acreage) Isles of Man and Channel Islands.

## PRODUCE OF CROPS IN GREAT BRITAIN IN 1899.

Although the produce returns collected for the Board of Agriculture by the estimators selected by the Collectors of Inland Revenue could not be expected in 1899 to furnish results rivalling those of the remarkably abundant season of 1898, they show that the average of production was well maintained. Turnips alone, out of the eleven crops on which reports are made, showed a marked deficiency in yield, although the potato crop fell in some degree, and that of clover hay to a smaller extent, below the standard of the previous ten years.

*The Weather of 1899.*—Before referring in detail to the various crops, it may, as last year, be of interest to refer to the characteristics distinguishing the weather of 1899. The records of observations published by the Meteorological Office show the number of days on which rain fell to be less than in 1898, although the aggregate amount of rain was greater, the total mean rainfall at the various stations in the British Isles generally standing at 33·8 inches, as compared with 30·9 inches in the preceding year and with an average of 34·4 inches for the thirty-four years 1866–99. In some districts of England, and notably in the eastern counties, the deficiency from the average was no doubt greater than these figures show ; but, on the other hand, in Scotland the rainfall seems to have considerably exceeded the mean of the thirty-four years. The mean temperature for the year was recorded as 49·5 degrees Fah., or just half a degree below that of 1898, and one degree above the average. It appears, however, that the summer quarter, July to September of 1899, was appreciably warmer than that of the preceding year, the mean temperature for these three months being 60·1 degrees, a level not much under that recorded in the remarkable season of 1868.

The weather in January was extremely unsettled until the close of the month, when it became fairly dry and cold. Rainfall was in excess of the average over the country generally. For the first fortnight of February the weather was unsettled, but the latter half of the month was finer, with a large amount of sunshine, which continued during the early part of March, to be again followed by inclement conditions, with cold north winds, sharp frosts, and snow. April maintained its changeable character with an excess of rain ; and, except in the first and last weeks, similar conditions prevailed in May.

On the whole, the spring was thus unfavourable for farming operations, and the season backward. In the earlier half of June, however, the weather became very fine and dry, conditions which, although interrupted towards the end of the month, recurred again in the latter part of July, when a drought set in, which continued over the greater part of the country with very little intermission until the end of August. September was again unsettled, with heavy rains at intervals, but, except in the northern districts, the temperature continued considerably above the normal. October

tly fair and dry, and, after the first ten days, the weather  
mber was fine and bright, wintry conditions with hard frost  
y all districts being developed about the middle of  
er, and again in the closing days of the year.

*Yield of Crops in 1899.*—The relation of the year's crops in  
Britain to the average for the preceding ten years, and also  
results of each of those years, is shown in Table I., by  
taking the decennial average for 1889-98 as 100, and calcu-  
lating the estimated production per acre of the principal crops in  
to that standard.

*I.—Comparison of Estimated Yields per Acre for 1899 in  
Great Britain with Estimated Yields for former Years.*

WHEAT	BARLEY	OATS	POTATOES	TURNIPS and SWEDES	HAY (Clover)	HAY (Permanent grass)
Average 1889-98, 29-86 bushels per acre =100	Average 1889-98, 33-26 bushels per acre =100	Average 1889-98, 38-86 bushels per acre =100	Average 1889-98, 5-95 tons per acre =100	Average 1889-98, 13-43 tons per acre =100	Average 1889-98, 28-32 cwt. per acre =100	Average 1889-98, 23-06 cwt. per acre =100
100	96	101	104	109	118	127
103	105	107	89	106	108	116
105	103	100	96	99	101	102
88	104	100	97	105	90	83
87	86	92	111	99	66	54
103	104	107	93	100	115	124
88	95	95	112	96	96	83
113	101	95	106	92	85	76
97	99	99	87	104	103	108
116	107	105	105	90	119	127
110	103	100	94	69	97	100

It will be observed that in two instances, viz., oats and hay cut  
permanent grass, the crop of 1899 appears as an average.  
Although not such a remarkable crop as in 1898, was 10 per  
cent above the ten years' mean, while turnips and swedes fell 31  
per cent below the average.

*Estimated Yield of Wheat.*—The total production of wheat in  
Britain was less by nearly a million quarters than in 1898,  
the estimated aggregate being 8,191,000 quarters. This, however,  
was considerably more than was recorded in any year since  
1898, with the exception of 1898. The average produce per acre of  
wheat in 1899 was 32-75 bushels, or nearly 3 bushels over the  
ten years' mean, but it was two bushels below the yield of the im-  
mediate preceding season, and nearly one bushel below the yield  
of the preceding year.

With the exception of these two years, however, the  
wheat crop recorded since the official estimates have been  
made was reaped in 1899.

In two exceptions, in districts of small wheat area, every  
county reported an over-average yield. Relatively, the best

results were recorded in Essex, Cornwall, and Bedford, where yields exceeding the average by 6·71, 5·42, and 5·15 bushels per acre respectively were returned. Wales returned a crop which was only half as much over the normal standard as that of England, while in Scotland the crop was barely half a bushel per acre over the decennial average, and in several counties the year's production was in fact substantially less.

*Estimated Yield of Barley.*—The yield per acre of barley in Great Britain in 1899 was 34·16 bushels per acre, exceeding the average by 3 per cent. or nearly a bushel, but falling below the "record" yield of the previous year by more than a bushel and a half. The crops reported in Cornwall, Hertford, Durham, Hereford, Devon, and Essex in England, and Kirkcudbright and Dumfries in Scotland, were most largely above the local average. North of the Tweed, however, the barley crop was generally below the average, the net deficiency being rather more than 2 bushels per acre.

*Estimated Yield of Oats.*—The crop of oats was, for Great Britain, as nearly as possible an average, or just fractionally below the ten years' standard. In England, however, the yield was 41·5 bushels per acre, or two-thirds of a bushel over average, while that of Wales was also above the mean, one county—Pembroke—reporting a crop of 44 bushels, or 12 bushels over average. On the other hand, in Scotland, where a third of the area of oats in Great Britain is found, the yield barely exceeded 34½ bushels per acre, or nearly 2 bushels below the local average. Among the English counties, Essex, Suffolk, and Cornwall appear to have secured the best results with crops nearly 5 bushels per acre over average.

*Estimated Yield of Potatoes.*—The yield of potatoes in Great Britain in 1899 was one-third of a ton per acre less than the average, the deficiency in England alone being one-fourth of a ton, and in Scotland two-thirds. In 1898, on the other hand, the relative positions were reversed, both countries having an over-average crop, but that of Scotland being the more abundant of the two.

*Estimated Yield of Root Crops.*—The turnip crop of 1899 was the worst which has been recorded since the Produce Returns have been collected. The average yield per acre for Great Britain as a whole was estimated at only 9½ tons, or nearly 4½ tons below the mean of the preceding ten years. The nearest approach to so low a return was in 1887, when the yield for Great Britain was estimated at 10 tons per acre. Although the results were less conspicuously bad in Scotland than in England, the general failure of the crop was such that in the whole country only Orkney and Shetland secured a crop exceeding the local average. In some whole counties this root crop appears to have come within measurable distance of disappearing altogether. Thus in Warwick and Worcester the estimated yield per acre was less than 4½ tons, and in several others less than half an average crop was recorded. A fair crop of mangels in England was, on the other hand, secured from an extended acreage, the yield being slightly below that of 1898, but rather above a ten years' average, and, although the results in Wales

and in Scotland were in the other direction, the cultivation of mangels is insignificant in these parts of Great Britain.

*Estimated Yield of Hay.*—The yield of hay from permanent pasture in the past year was practically an average (being deficient by only 0·11 cwt.). This was small by comparison with the great crop of 1898, below which it fell by more than 6½ cwt. per acre. There was a good deal of local variation in the yield. In twenty-seven English counties the crop was under the local decennial average—in one instance, Cambridgeshire, by as much as 4½ cwt. per acre. In sixteen other cases the results exceeded the average, one or two counties in this category appearing to have been specially favoured—possibly by the meteorological circumstances of the season. In Herts the quantity of meadow hay cut per acre was put at more than 5 cwt. over the average for the preceding decade, and in Derbyshire the excess was almost as great. In Scotland similarly wide variations occurred—Dumfriesshire, for example, giving a yield 8 cwt. above, and Lanarkshire one of 7 cwt. below the average.

While the total crop of meadow hay amounted to nearly five million tons, that of clover hay barely exceeded three millions, the acreage of the latter being little more than one half that of the former, and the yield nearly 1 cwt. per acre less than an average. The greatest local deficiency in the yield of hay from clovers and rotation grasses occurred in Middlesex, where the crop was as much as 9½ cwt. below the average, while in Cambridge and Surrey the deficiency exceeded 6 cwt. per acre. Wales differed from England and Scotland in having an over-average crop, the excess being 1½ cwt. per acre above the mean of the previous ten years.

#### CROPS OF THE UNITED KINGDOM.

The returns of produce hitherto referred to have been those relating to Great Britain only, but by adding the figures for Ireland it is possible to show, as in Table II., the results of the harvest for the whole of the United Kingdom, so far as the principal crops are concerned. The cereal crops are placed in the order of their relative bulk, the changes in the acreage as well as the yield affecting the aggregate results appearing in the figures here contrasted.

TABLE II.—*Estimated Total Produce of Crops in the United Kingdom.*

Crops	1897	1898	1899
	quarters	quarters	quarters
Oats . . . . .	20,445,000	21,572,000	20,767,000
Barley . . . . .	9,077,000	9,341,000	9,317,000
Wheat . . . . .	7,037,000	9,361,000	8,408,000
	tons	tons	tons
Potatoes . . . . .	4,107,000	6,225,000	5,887,000
Turnips . . . . .	29,785,000	26,499,000	20,370,000
Mangel . . . . .	7,379,000	7,228,000	7,604,000
Hay (all sorts) . . . .	14,043,000	15,916,000	12,898,000

## NUMBERS OF LIVE STOCK IN GREAT BRITAIN.

The Returns of live stock in 1899 were on the whole satisfactory, cattle, sheep, and pigs all showing a distinct increase, while in the case of horses there was practically no change, the total being only 530 below that of the preceding year.

*Horses.*—The slight net decrease in the number of horses in Great Britain was accompanied by movements which, regarded in detail, are not unsatisfactory. The diminution in the number of unbroken horses less than one year old returned in 1897 and 1898 necessarily left its mark in the group of those of one year old and above. But in 1899 there is once again reported an increase of 3,644 in the younger section, and of more than 10,000 in the main class of horses used for agriculture including mares kept for breeding.

*Cattle.*—The total number of cattle in Great Britain showed an increase of 173,000, or 2·6 per cent. on the year, and this result was achieved notwithstanding that Scotland by itself showed a decrease on the year before. Every county in England and Wales—London and Middlesex only excepted—contributed to the larger stocks of 1899. The greatest advance occurred in cattle under one year, which were augmented by 87,000, or 6·6 per cent., and this increase was again, as in 1898, chiefly noticeable in the English and Welsh breeding counties—Devon, Shropshire, Cornwall, Somerset, the West Riding of York, and Hereford being among the highest in the list. The same remarks apply generally in the case of cows and heifers in milk or in calf, which showed a total increase of 84,000, or a gain of 3·2 per cent. on the year.

Table III. exhibits the progress which has been made, both absolutely, and relatively in regard to the population, in the numbers of horned stock of Great Britain in the past five years.

TABLE III.—*Numbers of Cattle in Great Britain.*

Year	Population of Great Britain	Cows and heifers in milk or in calf	Other cattle	Proportion of cows to 1,000 persons	Proportion of other cattle to 1,000 persons
1895	34,538,701	2,486,000	3,868,000	72	112
1896	34,904,204	2,512,000	3,982,000	72	114
1897	35,273,634	2,532,000	3,968,000	72	112
1898	35,647,024	2,587,000	4,035,000	73	113
1899	36,024,438	2,671,000	4,125,000	74	115

*Sheep.*—A similar gain in breeding stock is told by the returns for sheep. The net increase of the flocks of Great Britain was 496,000, or 1·9 per cent., and it would have been greater but for a decrease of 163,000 in the number of the older sheep other than breeding ewes, the addition to the number of ewes kept for breeding being 323,000, and to the number of lambs 336,000, in both cases

increases of 3·2 per cent. The augmentation of the ewe flock was general, although the Scottish share was the least. In the case of sheep under one year, the increase was confined to England and Wales. North of the Tweed, local additions in various counties, amounting in Aberdeenshire to nearly 7,000, and in Shetland to nearly 5,000, were more than counterbalanced by the heavy reductions in a few counties, headed by Argyllshire, which recorded a falling off of nearly 22,000 lambs. Considerable progress has nevertheless been made in recent years towards a replenishment of the sheepfolds of Great Britain as a whole, and this is particularly noticeable in the increase of the ewe flock as shown in Table IV.

TABLE IV.—*Numbers of Sheep in Great Britain.*

Year	Ewes kept for breeding	Other sheep of one year and above	Total of ewes and sheep one year old and above	Lambs	Total of sheep and lambs
1895	9,663,000	6,334,000	15,997,000	9,795,000	25,792,000
1896	9,926,000	6,428,000	16,354,000	10,352,000	26,706,000
1897	10,007,000	6,219,000	16,226,000	10,115,000	26,341,000
1898	10,138,000	6,204,000	16,342,000	10,401,000	26,743,000
1899	10,461,000	6,041,000	16,502,000	10,737,000	27,239,000

*Pigs.*—The number of pigs increased on the year by 7 per cent., the total returned on June 5 in Great Britain being thus considerably larger than in the two preceding years, although this class of stock is not yet restored to the numbers returned in 1895 and 1896. Table V. shows the five years' movement.

TABLE V.—*Numbers of Pigs in Great Britain.*

Year	Sows kept for breeding	Other pigs	Total pigs
1895	415,000	2,469,000	2,884,000
1896	394,000	2,485,000	2,879,000
1897	334,000	2,008,000	2,342,000
1898	362,000	2,089,000	2,451,000
1899	376,000	2,248,000	2,624,000

## THE SPRING OF 1900.

FROM an agricultural point of view the spring of 1900 was by no means favourable, the progress of vegetation having been seriously retarded, firstly by an undue prevalence of cold cloudy weather, and secondly by a large deficiency in the amount of rainfall. The earlier half of the season was especially harsh and inclement, the wind being mostly from some northerly point, with frequent falls of snow

or sleet and occasional very sharp frosts. Up to April 13 the shade temperature in London had not once risen as high as  $60^{\circ}$ , a state of things without parallel in the history of the previous thirty years, though very nearly equalled in 1887 and 1888. In 1887 a reading of  $60^{\circ}$  was attained for the first time only two days earlier, and in 1888 only one day earlier than it was this year. In every other case mild weather commenced much earlier in the season, and in four years out of the thirty a reading of  $60^{\circ}$  was observed in London some time in February, last year being especially distinguished by a reading as high as  $66^{\circ}$  on the 10th of that month. The state of things existing this year in the metropolis seems to have been common in most other parts of the country, but at one station in our eastern counties (Geldeston, near Beccles) a temperature of  $60^{\circ}$  was recorded as early as February 24, the March maximum at the same place being, however, three degrees lower.

After the middle of April the thermometer rose steadily to an unusually high level for the time of year, as if to atone for the deficiencies it had shown in the earlier part of the season. The weather was, however, too dry to give real satisfaction to the farmer, and the heat was not maintained, a sharp fall of the thermometer taking place after the 22nd, with night frosts of considerable severity on the 25th and 26th.

May proved, as in so many recent years, a cold cloudy month, and about the middle of the period destructive ground frosts were experienced in several of the more central districts. Over the greater part of England the weather was also very dry, the absence of rain being especially marked in the south. At some places in the eastern and midland counties the deficiency was not great, while in Wales the rainfall was a little in excess of the average.

With such untoward conditions the close of the spring found the crops mostly in a backward state. Owing to the lack of anything like continuous warmth, the wheat and other cereals made slow progress, while the absence of rain hindered the growth of vegetation generally and led to considerable anxiety as to the hay crop. Up to the close of the first week in June the weather prospects had undergone little improvement, copious showers being still greatly needed in most districts.

The leading features in the weather of the entire spring are shown in a statistical form on p. 391, the following remarks giving further details of interest in the history of each particular element.

*Temperature.*—The mean temperature was below the average throughout nearly the whole of March, the weather being especially cold during the last ten or twelve days of the month. The first week of April was also cold, but after that the thermometer was mostly above the average until the beginning of May. For the remainder of the season the weather was again cold, the deficiency of heat being very large in the third week of May. Taking the spring as a whole, the mean temperature was below the average in all districts excepting the north-eastern and the Channel Islands, the deficit being greatest over Wales and our western and central counties.

Temperature, Rainfall, and Bright Sunshine experienced over England and Wales during the Thirteen Weeks ended June 2, 1900.

(The Spring Season.)

Districts	TEMPERATURE							
	High- est ob- serv- ed	Low- est ob- serv- ed	Day temperatures		Night temperatures		Day and night temperatures combined	
			Mean	Differ- ence from average	Mean	Differ- ence from average	Mean	Differ- ence from average
North-eastern counties . . .	74	13	50·7	-0·1	38·8	+0·2	44·8	+0·1
Eastern counties . . .	77	20	52·9	-1·0	38·0	-0·1	45·5	-0·5
Midland „ . . .	76	15	53·2	-1·4	37·4	-0·3	45·3	-0·9
Southern „ . . .	78	23	53·5	-1·0	39·8	-0·3	46·7	-0·6
North-western counties, in- cluding North Wales . . .	71	19	51·3	-1·5	39·4	-0·5	45·4	-1·0
South-western counties, in- cluding South Wales . . .	73	19	53·2	-0·3	39·7	-1·3	46·5	-0·8
Channel Islands . . .	69	32	54·0	+0·3	44·3	-0·1	49·2	+0·1

Districts	RAINFALL				BRIGHT SUNSHINE			
	Days with rain		Total fall		Duration		Percentage of possible amount	
	Num- ber	Differ- ence from average	Am- ount	Propor- tion of average amount	Hours re- cord- ed	Differ- ence from average	Per- cent- age	Differ- ence from average per- centage
North-eastern counties . . .	33	-11	3·2	58	350	-68	27	-6
Eastern counties . . .	35	-6	3·7	71	482	-16	38	-2
Midland „ . . .	34	-6	3·9	69	392	-23	31	-2
Southern „ . . .	30	-9	3·5	63	477	-32	38	-3
North-western counties, } including North Wales . . .	36	-7	4·7	76	476	+43	38	+4
South-western counties, } including South Wales . . .	38	-7	6·2	83	525	0	42	0
Channel Islands . . .	40	-6	5·0	83	589	+26	47	+2

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office. The averages employed are : For Temperature, the records made during the twenty-five years, 1871-96 ; for Rainy Days, the values for the fifteen years, 1881-95 ; for Total Rainfall, those for the thirty years, 1866-95 ; and for Bright Sunshine, those for the fifteen years, 1891-96.

Owing to the cloudiness of the weather the absence of warmth was as a rule greatest in the daytime. In the north-eastern counties, however, the temperatures both by day and night showed very little departure from the average, while in the south-western district the deficiency of warmth was very much greater at night than it was by day. A comparison with previous years shows that in our eastern, midland, and southern counties the season was as a whole rather warmer than in 1899 or 1898, but much cooler than in any of the five preceding years. In the north-west, however, it was a trifle warmer than the spring of last year, while in the north-east it was warmer than in either of the three years 1897-99. The highest temperatures of the season were recorded on April 20 and 21—on the former date in the north, but on the latter date in the south—the maximum shade readings being above 70° in all districts excepting the Channel Islands, and above 75° in several parts of the eastern, midland, and southern counties. At Hillington (Norfolk) the thermometer rose on the 21st to 77°, and in London to 78°. In May the thermometer scarcely exceeded 70° in any part of the United Kingdom, the complete absence of summer warmth being very unusual for the time of year. Over the country generally the absolute maximum temperatures of the spring were higher than in either of the three preceding years. They were, however, nothing like so high as those registered in the springs of 1896 or 1895, the thermometer in the earlier of these two seasons rising to 85° and upwards in several parts of England. The lowest temperatures of last spring were recorded as a rule on March 17 and 18, when the sheltered thermometer fell to 20° or less in many parts of the country, to 15° at Aberystwyth and Hereford, and to 13° at Durham. Sharp frosts were experienced also at several other times in March, and over the northern and central districts on the night of April 25. At the latter advanced date the thermometer fully exposed on the grass fell to 17° at Worksop, to 19° at Loughborough, and to 23° at Hillington and Oxford. Further ground frosts of a rather destructive character occurred in the middle of May, the exposed thermometer at Loughborough falling on the night of the 16th to a minimum of 25°. Over the country generally the sharpest frosts of the spring were less severe than those of last year, but with that exception they appear to have been sharper than in any spring since that of 1892. At some places in the North of England they were far more severe than anything experienced during the springs of the previous seven years.

*Rainfall.*—In eight weeks out of the thirteen the rainfall was deficient over the whole country, the driest periods of all occurring at the beginning of March and the middle of May. In four other weeks the deficiency was confined to more limited areas, chiefly to the northern, the only week with anything like a general excess, and that a slight one, being the second in May. Taken as a whole the season was therefore a very dry one, the amount of rain in all but the south-western district and the Channel Islands being at least 20 per cent. less than the normal. In the midland counties the

deficiency amounted to 31 per cent., and in the southern counties to 37 per cent., while in the north-eastern districts the total fall was only 58 per cent. of the average. At some individual stations the results were far more striking than the generalised values given for large districts, one of the driest localities of all being London, where the total rainfall for the three months March, April, and May was less than two-and-a-half inches, or only just one-half the normal. Over England as a whole the past spring was undoubtedly the driest experienced since that of 1893, and in London it was with that solitary exception the driest for at least 30 years past. In the south-western district and the Channel Islands, however, the spring of 1896 was drier than that of the present year. The absence of rain during the season is shown not only by the smallness of the total fall, but also by a striking falling off in the number of days on which a measurable amount was recorded. This was in nearly all places smaller than in any spring of the past six years, and in London it was, with the exception of 1893, the smallest recorded since 1883. In so dry a spring one would naturally expect to find very few cases of individual heavy falls of rain. It is, however, seldom that the season escapes with so conspicuous a lack of such occurrences as in the period under review. In the returns published by the Meteorological Office, supplemented by those given in Symons' "Meteorological Magazine," we have only been able to find two instances of a daily fall exceeding one inch. One of these occurred at Seathwaite, in Cumberland, where 2·2 inches fell on April 11, and the other at Skipton, where 1·7 inch fell on April 12. The neighbourhood of Seathwaite is, however, the wettest in the whole kingdom, and the fall of over two inches there possesses no such significance as would attach to a similar event in any of the drier portions of England. Snow and sleet were very frequent in March, principally at the middle and end of the month. Showers of snow were also experienced in the north and east of England on April 2, but after this the only entry of the kind was on May 12, when a few flakes were seen in the neighbourhood of Manchester. Thunderstorms, or thunder only, occurred rather frequently. In March they were recorded on the 16th at Liverpool, and on the 19th in several isolated parts of the country. In April they occurred on the 3rd and 5th in the north and east of England, on the 15th at Kew, and on the 16th over the eastern and south-eastern counties generally, the storms of the last-mentioned date being short, but severe, especially in Kent, where loss of life was reported. In May there were thunderstorms on the 6th in the south-east of England, on the 22nd over the north-eastern counties, on the 23rd at several places in the west and north, and on the 24th in the north and east.

*Bright Sunshine.*—During the earlier half of the spring, the amount of bright sunshine varied considerably from time to time, the finest week being the last in March, and the duller weeks the first and third in the month. In the latter half of April the duration was in excess of the average, but for the remainder of the

season the weather was mostly cloudy ; the only week with any general excess of sunshine being the third in May. Taking the spring as a whole, we find that in all the eastern, central, and southern parts of the country, the total duration was less than the average, the deficiency being large in the north-eastern counties. In the south-west, however, the amount corresponded exactly with the average, and in the Channel Islands there was a slight excess, while in the north-west of England there was a rather considerable excess. A comparison with previous years shows that in the north-eastern, midland, and southern counties, the amount recorded was less than in the spring of 1899, and that in the north-east it was as a matter of fact the smallest for at least seven years past. In the midlands and south, however, it was not so small as in 1898, while in the south-western district and the Channel Islands it was the largest experienced since the spring of 1896.

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## ARTIFICIAL CHANGES OF PHYSICAL PROPERTIES OF SOILS.<sup>1</sup>

In this paper the author considers what practical means may be employed to impart to cultivated soils the greatest possible productiveness. That the proper cultivation of the soil is of prime importance is shown by the fact that other factors important in plant growth, *e.g.*, the plant food supplied by manures, can exert their full power only when the mechanical condition of the soil is favourable. Uncultivated soils generally fail to produce maximum yields. The most favourable physical conditions exist in those soils which consist of a thorough mixture of the several principal ingredients. Thus, soils in which either finely divided (clayey) or coarsely divided (sandy) ingredients predominate are unfavourable to the production of crops without decided changes in their properties, while soils in which the ingredients are mixed in certain proportions (medium soils) are generally productive. It is well known, for instance, that a pure humus soil, mainly on account of its physical nature, is not favourable to plant growth, but may be rendered productive by admixture with a soil deficient in humus.

### PROPERTIES OF SOILS AS INDICATING THE NATURE OF THE CULTIVATION REQUIRED.

It is evident that in studying the various ways of cultivating soil, not only cohesion and adhesion, but also friction of the soil with the tools and the weight of a unit-volume of the soil, must be considered. The force with which the particles of soil cling to each other (cohere) is of prime importance in connection with the culti-

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<sup>1</sup> From a paper by Ewald Wolny, Ph.D., in the *Experiment Station Record*, vol. xi, No. 7. U.S. Department of Agriculture.

the soil, since the ease or difficulty with which tools penetrate the soil, and hence the labour required to cultivate the soil, depend primarily upon it. The controlling influence of cohesion may be deduced from the fact that it is the main factor determining the difference between soils, although the other properties of soils should also be taken into account, since the resistance to be overcome in working is always due in part to them. In general, it may be said that humus offers the least resistance to cultivation, clay the most, while sand stands between the two extremes.

If we asked what practical means should be used to reduce to a minimum the labour of working soils, we should recommend a change in composition of the soil as the first step. Thus, the mixing of clay with sand diminishes both cohesion and weight of the soil, and renders it more easy to cultivate. It is by this treatment both the weight and friction of clay are reduced, but, as modifications of cohesion and adhesion are more important, the increase in weight and friction may be neglected. The improvement of the tillable properties of soils may be most readily attained by an increase in the proportion of humus. The weight of clayey soil is by this means rendered very much less, because both cohesion and adhesion, and also the weight, are diminished in proportion to the amount of humus added. For this reason also an increase of humus is of advantage, as it reduces the weight and decreases the weight. It thus appears that manuring with materials of organic origin (stable manure, vegetable matter, and peat) greatly increases the ease of cultivation, and at the same time influences most favourably the chemical properties of the soil in many different ways. Nor should the fact be overlooked that the increase of the humus content promotes the tendency of the soil to become 'crumbly' structure, and by this means still further reduces the mechanical resistance to cultivation. Soils of crumbly structure are not only naturally more fertile, but are very much more easily worked than those having a separate grain structure. Soil manipulations, therefore, promote the formation of the crumbly structure and tend to make such structure permanent and of great value in soil cultivation, inasmuch as they both lighten the weight of the soil and lessen the labour required for its cultivation. This is especially true of compact, heavy soils. To obtain a crumbly structure and to preserve it, several fundamental principles must be observed. These may be summed up briefly as follows: (1) The soil must be ploughed immediately after the crop is gathered; (2) it must be ploughed only when it contains a considerable amount of water (about 40 per cent. of that which the soil is capable of holding); (3) the furrows must be as narrow as possible, especially at the first ploughing; (4) the land destined for spring sowing should be exposed in roughly ploughed condition to the action of frosts during the winter; and (5) the formation of humus in the soil should be promoted by means of proper fertilizers. For the latter purpose humus-forming manures (stable and guano manure) as well as calcium hydrate (freshly slaked lime)

are especially valuable. Hurtful influences, on the other hand, are exerted by such fertilisers as contain carbonates of the alkalis and soluble phosphates, inasmuch as these when applied in considerable quantities cause the soil particles to pack closely together. The same is true of materials rich in chlorides and nitrates. These salts promote the formation of crumbly structure while they remain in the soil, but when they are washed out by the rain water, they leave the soil in a puddled condition. This happens more or less with all salts which are not fixed by the soil. This can be corrected only by a careful selection and application of measures calculated to increase and preserve the percentage of humus in the soil.

#### RELATIONS OF SOILS TO AIR.

From the standpoint of the agriculturist, the principal property of soils in their relation to air is permeability, for on it depends the supply of oxygen required both for normal decomposition of organic material and for the respiration of the roots. The smaller and more densely packed the soil particles, the more limited the supply of oxygen and the greater the necessity for attempting to regulate the permeability. This end is best attained by mixing a fine-grained soil with sand and by inducing a crumbly structure. If too great humidity of the soil is responsible for the lack of permeability, only thorough drainage can correct the defect. If the soil has been deprived of its permeability by washing during periods of extraordinarily heavy precipitation, the best remedies are harrowing and hoeing between the rows, and heaping up the soil around the plants. The latter is a most efficient means of increasing permeability of the soil.

#### RELATIONS OF SOILS TO WATER.

Excess of water, either temporary or permanent, is hurtful to plant growth to a greater or less extent. Such a condition is a result principally of heavy precipitation on soils of high water capacity. The damage is most marked in the case of basin-shaped fields on which water from neighbouring fields accumulates, or which have an impervious subsoil at such a depth that the soil is kept in a state of saturation. The means adopted to correct this state of affairs will depend upon whether there is a permanent or only temporary excess of water. If the excess of water remains permanently or for a long period, it can be removed only by under-drainage or by the construction of ditches. The physical structure of the soil, more particularly its permeability and water capacity, determines the amount of water that may be removed by this means. The efficiency of the method consequently varies widely in different localities. A blind adherence to common rules of drainage may in some cases reduce the water supply in the soil to a degree dangerous to plant growth. This is the case (1) in all soils of small water capacity and considerable permeability (coarse-grained, sandy soils), (2) in soils offering considerable facilities for evaporation

bog earth), and (3) in all soils occupied by plants considerable amounts of moisture in the upper soil layer (perennial forage plants).

While the methods noted are effective in removing the excess of water, they may bring about a condition of dryness in most cases, especially where rain is rare, and in time of drought unfavourable to the growth of maximum crops. To do this, the difficulty, which militates against the best interests of tillage of land, such means of regulation ought to be used which will either cause the water to drain off more slowly, or complete stoppage of all flow temporarily. The former can be done only imperfectly, because in the end all the water not in the soil is removed; in the latter case, however, with proper regulation of moisture may be thoroughly utilised in accordance with the needs of the soil and the requirements of crops. Drainage can be controlled effectively with open ditches, but it may very easily be done in case of under drains by calculating the diameter of the pipe on the basis of the quantity of water that percolates through hard, heavy soil. According to the experiments of H. G. Carter, this amounts to 0.0008 cubic metre, or 0.8 litre per second per hectare ( $=0.56$  pint per second per acre). With this rate of flow and starting with the smallest feasible diameter of pipe (1.6 in.), the drainage system may be so constructed that the moisture may be kept in the soil for a long time. This, however, hardly answers the purpose, since the humidity of the soil, during the period of plant growth, cannot be fully regulated.

Hence it is recommended that open ditches be provided with dams, and drains with flood gates, by means of which the flow of water may be interrupted either partly or entirely, as the circumstances may require. This method is simple and easily applied in any form of drainage.

The higher portions of a dangerously moist field should be used for grains and hoed crops, while the lower parts are used for crops which possess a high power of evaporation (such as clover).

Even in this case, however, the plants will suffer if the moisture in the soil exceeds 70 to 80 per cent. of saturation.

Temporary pools which form on very fine-grained soils during heavy rains must be removed either by direct withdrawal of the water (by means of water-furrows), or by such means as will bring about a reduction of the water capacity; in other words, an increase in the water capacity or an increase of evaporation from the soil. In the former case, the effort must be directed principally toward producing a porous structure through cultivation and manuring, as suggested above. By this means the water-holding capacity of the soil is reduced and percolation promoted. On extremely fine-grained soils (black earth), which in their unmodified condition offer great resistance to the passage of water and become very moist only with the greatest difficulty, this process is very difficult. It is possible in order that the precipitation may be of any use at all. A favourable modification of the water capacity and

penetrability of such soils may also be brought about by admixture of soils of opposite physical characteristics, as, for instance, coarser grained soil (sand). By this means stiff soils are rendered more easy to cultivate, and are more readily changed into a condition of separate grain structure.

Enlarging the surface of evaporation, as is done in ridge and hill culture, is another means of preventing harmful accumulation of water in soils. By this means, also, a portion of the rain water is removed from the reach of the plants by flowing into the furrows between the rows.

Close planting also assists to some extent in reducing the moisture in the soil by increasing the amount of water drawn from the soil by the crop.

It is a mistake to allow wet soils to lie fallow, especially in wet seasons, because the conditions in fallow soils are much less favourable to evaporation than in cultivated soils. Allowing soils to lie fallow, however, is not harmful; on the contrary, it may be useful, if the soil during a previous long drought has become dry to a considerable depth.

Lack of moisture in a soil may be corrected either by direct application of water (irrigation) or by increasing the absorptive power of the soil. Irrigation is to be recommended in all cases in which the water supplied by precipitation is insufficient for the production of maximum crops. The point at which irrigation becomes necessary varies in different localities and is determined by the energy of evaporation, the water-holding power of the soil, and the distribution of precipitation. In the warmer climates we may assume, as a rule, that when precipitation is less than 24 to 28 in. irrigation is required for maximum crops, while in colder localities in which evaporation is less rapid and crops smaller, on account of the low temperature, the limit may be placed at about 16 in.

With regard to the treatment of soils which have little water capacity, great permeability, and favourable conditions for evaporation, the aim should be mainly to keep the ground water at a proper level, or, if this is not possible, to increase the water capacity of the soil. The latter may be accomplished by admixture of fine-grained, earthy materials (clay, loam, and marl), or by increasing the percentage of humus through liberal applications of manures of organic origin (stable manure, peat, &c.). Another, though less effective, means is rolling the soil, provided it be followed at the beginning of dry weather, by harrowing, hoeing, &c., to reduce evaporation.

For soils of small water capacity such operations as limit evaporation as far as possible are generally recommended. Too frequent ploughing of the soil should be avoided, and ploughed land should be harrowed as soon as dry weather sets in, to reduce the surface of evaporation as much as possible. If the soil becomes too hard, as may happen as a result of violent rains or of rolling, loosening of the surface (harrowing, hoeing) is of great advantage in reducing evaporation and thus retaining moisture in the soil. Furthermore,

ridge culture is to be avoided, since in this case evaporation is greater than in level culture. Close planting should not be made for the same reason. Allowing the soil to lie fallow may be in the storage of moisture in the soil, but it is recommended when the soil is dry to a considerable depth. Finally, mulching the soil with a layer of dead vegetable matter (stable manure, straw, &c.) reduces evaporation from the soil for a time at

#### RELATION OF SOILS TO TEMPERATURE.

Keeping in mind the great influence directly and indirectly of the temperature of the soil upon the growth of plants, the practical agriculturist will endeavour to find means to modify the temperature according to the necessities of the plants. In cold climates, naturally, efforts must be made to promote a rise in temperature, while in warmer regions it will often be necessary to do so in the opposite direction. In what ways and to what extent the temperature of the soil may be influenced is briefly described below.

In the cultivation of plants which furnish products of high market value, such as vines, fruit trees, &c., and which require a high temperature, artificial changes in exposure or inclination (such as giving south-west, south, or south-east exposure, or inclining the plants more directly toward the south) may be of considerable benefit, especially in cold climates. The method, however, is productive of good results only when the soil contains sufficient moisture, because only in that case is the higher temperature beneficial and the increase in yield sufficient to justify the outlay required to make the change. This method need not be restricted to hilly lands but can be applied to level soils. Roof-like elevations may be constructed, with broad surfaces facing toward the south, and rather narrow exposures toward the north. The former may be devoted to crops that require considerable warmth (vines, fruits, &c.), and the latter may be reserved for grass or such storage plants as require less heat. This method is not adapted to extensive field culture of crops furnishing products of comparatively low market value, both on account of the very unequal distribution of the plants on the two opposite inclinations, and because the benefit derived even under favourable circumstances would not justify the outlay.

On hilly land in hot climates a reduction of the temperature of the soil may be necessary on steep inclinations facing toward the north, south-east, or south-west, because under such conditions, not taking into account the fact that the moisture is generally insufficient for maximum crops, the temperature of the soil frequently exceeds the limits for the perfect development of plants. In such cases the construction of terraces offers special advantages, since by means of the terraces the temperature of the soil may be lowered and the moisture in the soil regulated in accordance with the needs of the crops. Another common method of altering the exposure of the

soil consists in the construction of beds, running through the whole length of the field, and separated from each other by furrows. The effect of this arrangement is to bring about a more rapid removal of water from surfaces of high water capacity, but, leaving out of account the fact that this result may be accomplished by similar means (water furrows), the process in question has the disadvantage of producing unequal heating of two oppositely inclined surfaces, resulting in unequal growth of the plants on the two sides. For this reason bed culture is not suited to fields that are to be planted with only one kind of crop. In such cases level cultivation, which secures a higher and more uniform temperature, is decidedly preferable. If, however, this method is followed, the bed should run north and south if the field permits, since the difference in temperature between the east and west slopes is far less marked than that of slopes facing north and south. In other words, the disadvantage of unequal heating is least with beds running north and south.

An excellent means of raising the temperature of the soil is the cultivation of plants in ridges or in hills. Soils so cultivated have a higher average temperature during the growing season than the cultivated level. The effect is of longer duration in ridge culture than in hill culture, because in the former the ridges are constructed before seed time, while in the latter the hills are made only in more advanced stages of growth of the plants. For this reason ridge culture is especially suited to plants which require a considerable amount of heat (maize, sunflower, beets, &c.) in climates unfavourable, as regards temperature, to the growth of these plants. However, this is true only for regions in which the weather in spring is not too cold, for the plants growing on the top of the ridges, on account of their exposed position, more easily injured by frosts in spring than those planted on the level soil and hilled later. As a general rule, both these methods are mainly adapted to such soils as have little capacity for collecting and retaining heat (clayey and calcareous soils), and which are also apt to collect excessive quantities of water. It is evident that the increase of temperature due to ridge or hill culture is of no advantage on soils of low water capacity and great permeability (sand) when precipitation is scanty. Under such conditions level culture is to be preferred. It should be remembered when ridge or hill culture is used that ridges running north and south are of higher and more uniform temperature than those running east and west.

Regulation of the store of water in the soil is another means of modifying the temperature. If the soil is wet, elevation of temperature is brought about by removal of the excess of moisture. The proper means to this end are direct removal of water, lowering water capacity, and increasing permeability of the soil, as already explained. That the desired result may be obtained by these means has been proved by various experiments. Another means of changing conditions of temperature in soils is intermixture with soils of opposite properties as regards heat. Admixture of sand with clay or earth rich in clay and limestone results, under normal conditions,

average increase in the temperature of the soil, while the process produces a lowering of the temperature of the soil. Thoroughly intermixing sand and humus soil a soil results which heats more rapidly and to a greater depth than is done by separately. Increase of humus in mineral soils, as, for example, by the liberal application of manures of organic origin, produces extremes of temperature.

We thus see that not only the structure of the soil but also its temperature may be affected by mechanical means. Change from a fine grain structure to a crumbly structure generally improves, to a small degree, the heat conditions of a soil, principally by increasing evaporation. Rolling the soil is more effective because it increases the conductivity of the soil for heat and therefore, under normal conditions of weather, raises the temperature of the soil. Loosening the surface of the soil by harrowing, hoeing, &c., has, on the contrary, in a decrease in the temperature of the soil.

Covering the ground with dead matter (mulching) the temperature of the soil is increased or decreased according to the nature of the covering toward heat. If, for example, a thin layer of black material (coal dust, black clay slate, &c.) is spread over the soil, the temperature of the soil rises to a considerable extent, and crops on soils so treated are accordingly benefited. Although this process, for evident reasons, is not applicable to cultivation on a large scale, still with delicate plants, especially in horticulture, it may be used to advantage. Spreading a layer of sand or straw over humus soils causes a rise in the temperature of the soil and wholly or partially prevents the frequent night frosts which occur during spring in such soils.

Mulching with dead organic matter (stable manure, straw, &c.) is used to lower the temperature of the soil during the warm months of the year. By the same means the influence of the temperature of the air is diminished, and the soil protected from all sudden changes in temperature. This is due to the fact that all the materials mentioned are poor conductors of heat. Allowing the manure to remain spread out during the warm months on the surface of the soil for some time before it is worked into the soil unfavourably affects the moisture of the soil. In the colder months of the year, however, it may be beneficial on account of its influence in raising the temperature of the soil. Under such conditions, however, the covering of manure may exercise a harmful influence on fine-grained clay soils rich in humus by preventing the warming effect of frosts, which is so important for such soils. Similar results may be obtained by thinly spreading a mulch in the fall over fields occupied by perennial forage plants, thus protecting the plants against low, and especially changeable winter temperatures. As, however, such a covering retards warming of the soil, the undecomposed remains of the mulch should be removed as the temperature begins to rise in the spring. We must keep in mind the fact that covering the soil in this manner

retards warming in spring, this practice may also be utilized to retard the blossoming of fruit trees, thus diminishing or preventing damage from late frost. If the ground surrounding the trunk is covered in spring with a heavy layer of straw, the temperature is kept low and in consequence the amount of water received through the roots is small, so that the development of the leaves, and especially the blossoms, is retarded for several weeks, or until the onset of reproduction are then in little danger of freezing.

Finally, the practice of keeping fields fallow (*i.e.*, without crops) is a means of increasing the temperature of the soil during the warm season. When the rise in temperature is accompanied by an increase in the water content of the soil decomposition of organic materials is promoted, and a greater or less quantity of plant food is stored in the soil. The only danger is that in permeable soils plant food may be leached beyond the reach of the plants by heavy rains.

## RECENT AGRICULTURAL INVENTIONS.

*The subjects of Applications for Patents from March 12 to June 2, 1900.*

N.B.—Where the Invention is a communication from abroad, the name of the Inventor is shown in italics, between parentheses, after the name of the applicant.

### Agricultural Machinery and Implements, &c.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
4780	FISCHER, A. T. .	. Cultivators, harrows and hillers.
4830	BRAWN, J. .	. Combined potato-raiser and plough.
4862	HORNSBY, J., & ors.	. Plough coulters.
5058	PROBERT, E. A. .	. Ploughs.
5103	HARMS, H., & anr.	. Potato-harvesting machine.
5261	HOUSE, J., & anr.	. Treating hops.
5371	BATTEESBY, R. .	. Digging and separating potatoes.
5411	MARSH, J. .	. Machine for making holes for planting.
6112	HOLME, T. .	. Spreading liquid manure.
6355	KELSEY, G. .	. Chaff-cutting machinery.
6397	SMYTH, J. J. .	. Distributing manure.
6501	SMITH, A. G. .	. Manure distributor.
6504	GIFFORD, J. .	. Implement for gathering hay.
6553	BAMFORD, S. B. .	. Chaff-cutting machines.
6868	MCLEAN, P. .	. Housing and drying cut crops.
6983	KEER, T. .	. Potato diggers.
6989	BROWN, P. S. & anr.	. " "
7054	PLATT, F. S. .	. Planting potatoes.
7160	SCHMÖLZER, K. .	. Scythes.
7215	WIECHELT, W. & anr.	. Manure drill.
7318	FLICH, F. & anr.	. Automatic sowing machine.
7361	BLACK, A. .	. Revolving sulky hay rake.
7574	BRAND, P., & anr.	. Cutters for hand-worked reaping machines.

Name of Applicant.	Title of Invention.
ALL, J. . .	Dibbing machine.
JOHNNERT, A. . .	Cleaning and sorting device for threshing machines.
AIGE, W. R. . .	Distributing manure.
ARKIN, J. . .	Potato diggers.
NTROBUS, A. . .	Potato-planting machine.
LEADOWS, W. G. . .	Twin plough.
IVSEY, A. M. . .	Rotary root thinner.
TANFORD, C. M. . .	Threshing machines.
USSEMEIB, H. . .	Mowing machines.
RIFFIN, H. . .	Haymaking apparatus.
RISTOW, C. & ors. . .	Seed-sowing apparatus.
WHITBECK, V. A. . .	Hilling corn or potatoes.
ELSTOCK, M. & anr. . .	Potato lifting and cleaning machines.
MURLING, W. W. . .	Combined rake, seed drill, and hoe.

### Stable Utensils and Fittings—Horse-shoes, &c.

BOARD, P. A. . .	Nosebag.
PRIVETT, A. & anr. . .	Roughing plate for horse-shoes.
MOORISON, A. S. . .	Horse-shoe pads.
LAKE, H. H. ( <i>Budd Doble Tyre Co., U.S.A.</i> ) . . .	Horse-shoes.
BEST, L. C. . .	Nosebags.
VON TRHU, P. . .	Halter.
TURNER, S. G. . .	Securing and retaining traces.
BAILEY, C. I. C. . .	Nosebag.
BROWN, W. . .	"
GOLBY, F. W. . .	Saddles.
AVILL, C. . .	Horse-shoes.
HUDSON, H. R. . .	Non-slipping horse-shoe.
RUSSELL, J. F.-M. . .	Harness.
ADKINS, W. W. . .	Hames.
OSBORN, J. H. & anr. . .	Spring hame-hook.
MUIR, A. N. B. . .	Horse-shoes.
WILLIAMS, W. O. . .	Kneecap.
DEITZ, E. . .	Horse-shoe pad.
BROOKES A. G. . .	( <i>Draper, G., U.S.A.</i> ) Horse clothing.
BIRCH, J. H. . .	Horse-shoes.
JULIEN-PINÇON, C. E. . .	Horse-collar.
TODD, H. L., & anr. . .	Nose-bag.
BRUGGEN, A. L. . .	Neck-yokes and vehicle-pole connections.
JONES, C. D. M. ( <i>Jones, R. G., India.</i> ) . . .	Safety attachment for stirrup-leathers.
VELDEN, W. . .	Horse-shoes.
PARKES & GNOSILL, Ltd., & anr. . .	Top-staples for collar hames.
SQUIER, J. W. . .	Horse lawn-mowing machine boots.
STEADMAN, T. . .	Pneumatic horse-collar.
WAITE, W. . .	Nose-bags.
BREIDERHOFF, O. . .	Stirrups.
PAAR, H. . .	Cushion horse-shoes.
ALBERT F. . .	Horse-shoes.
CHISWELL, W. . .	" "
NUNN, J. H. . .	Horse shoe pads.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
10102	TOLLEY, H.	. Shields for collars.
10151	BERNARD, P. L.	. Bits.

**Dairy Utensils, &c.**

4636	STEVENS, F. T.	. Fastening for milk churn.
5342	EVANS, A. O.	. Wheeled travelling milk can.
5566	ALEXANDER, & anr.	. Milk cans
5633	BASS, T. A.	. Attaching milk cans to doors, &c.
6043	ANDERSEN, P.	. Milking machines.
6290	KINGSLEY, B.	. Churns.
6887	MARKS, E. C. R., <i>Strauss, E., U.S.A.</i>	. Modification of milk.
6896	MEREDITH, A. P.	. Milk churns.
8499	HOEN, J. K. & ors.	. Cutting butter.
9950	FELDMEIER, H.	. Combined churn and butter worker.

**Poultry and Game, &c., Appliances.**

4705	WOODS, C. & H.	. Nonspillable drinking fountain for tra poultry and pigeon baskets.
4856	GEORGE, J.	. Incubators.
5614	LENO, E. P.	. Foster-mother for chickens.
6006	MÜNDHEIM, H.	. Testing eggs.
6507	LYONS, A. & ors.	. Incubators.
6835	DANDISON, P.	. "
7382	LYONS, A. & J.	. "
7510	MILES, C.	. Electrically-governed feeding and d appliance.
9945	ROE, C.	. Poultry, &c., brooders.
10024	HATELEY, A.	. Feeding and drinking fountains.

**Miscellaneous.**

5202	ASHTON, W. M.	. Device for holding sheep.
8752	RIPPERT, P.	. Preserving stable manure.
10107	MARTIN, A.	. Clipping and shearing apparatus.
10149	HAGYI-RISTIC, S. & anr.	. Improved fodder.

**Numbers of Specifications relating to the above subjects pub  
since March 10, 1900.<sup>1</sup>**

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Specifications of 1899.

3651, 5222, 7368, 7499, 8850, 9494, 9495, 10325, 10343, 10363, 10539,  
10727, 11252, 11694, 11706, 11972, 12041, 12205, 12257, 12370,  
12773, 13519, 13693, 13803, 14132, 14383, 14450, 15299, 15574,  
22901, 25126, 25471, 25501.

Specifications of 1900.

433, 485, 801, 2369, 2380, 2792, 2939, 3076, 3190, 3426, 3538, 4197, 439  
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<sup>1</sup> Copies may be obtained at the Patent Office (Sale and Store E  
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# JOURNAL

OF THE

## ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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### THE YORK MEETING, 1900.

tion occupied by Newcastle-on-Tyne since 1887 as entertained the Royal Agricultural Society on three occasions is no longer unique, for it is now shared by York. The Newcastle Meetings took place in 1864, and 1887, and the York Meetings in 1848, 1883, 1900, the last-named being the Society's 61st annual meeting. Before the recent Show the counties of York and Lincoln had each received the Society five times, but with the opening of 1900 Yorkshire is brought to the front as it has welcomed the Society within its spacious borders as often as six times, which represents on the average one Meeting per county. Subjoined are a few details concerning the six Meetings:—

Place of Meeting	President	Entries of Live Stock	Number of Imple-ments separately cata-logged	Persons paying for Admission
York	Earl of Yarborough	718	1,508	—
Leeds	Earl of Powis	1,027	5,488	145,738
Hull	Earl Cathcart	1,145	5,634	104,722
York	Duke of Richmond & Gordon	1,653	6,058	128,117
Doncaster	Earl of Ravensworth	2,221	5,347	111,500
York	H.R.H. the Prince of Wales	1,997	4,933	87,511

### THE SHOW GROUND

City of York is fortunate in having, within easy distance of the railway station, so extensive an area of level old land as is embraced by the famous Knavesmire, in

returning to which, after an interval of 17 years, the Show was practically taking up again its old quarters. The site, it is true, lacked the picturesque charm which added so much to the attractiveness of the Showyards at Mote Park, Maidstone, and Four Oaks Park, Birmingham, in the two preceding years. But it lent itself eminently to the purpose for which the Show was required, and the effective manner in which the ground was laid out called forth general approval. The main features of the plan can be readily grasped from an examination of the plan at pp. 4

### ENTRIES.

In the accompanying table are set out the entries at the 1900 year's Show, and—for comparison—at the Show of the two preceding years. The entries of horses and sheep at York

#### *Number of Entries at the last Ten Country Meetings (1891–1900)*

Number of Animals or Pens entered	York, 1900	Maidstone, 1899	Birmingham, 1898	Manchester, 1897	Leicester, 1896	Darlington, 1895	Cambridge, 1894	Chesham, 1893
Horses . . .	696	424	709	981	594	650	617	509
Cattle . . .	687	683	792	821	594	548	659	758
Sheep <sup>1</sup> . . .	614	631	694	701	551	505	588	631
Pigs . . .	—	147	198	185	144	—	—	161
<b>TOTAL . . .</b>	<b>1,997</b>	<b>1,885</b>	<b>2,323</b>	<b>2,688</b>	<b>1,883</b>	<b>1,703</b>	<b>1,864</b>	<b>2,059</b>
<b>Poultry . . .</b>	<b>629</b>	<b>609</b>	<b>964</b>	<b>867</b>	<b>901</b>	<b>769</b>	<b>705</b>	<b>836</b>
<b>Produce . . .</b>	<b>528</b>	<b>625</b>	<b>635</b>	<b>715</b>	<b>574</b>	<b>476</b>	<b>538</b>	<b>957</b>

Shedding in Implement Yard (in feet) [exclusive of open-ground space]	York, 1900	Maidstone, 1899	Birmingham, 1898	Manchester, 1897	Leicester, 1896	Darlington, 1895	Cambridge, 1894	Chesham, 1893
Ordinary . . .	ft. 9,454	ft. 7,455	ft. 9,350	ft. 9,320	ft. 8,506	ft. 7,528	ft. 8,435	ft. 8,610
Machinery in motion . . .	2,547	2,192	3,239	3,334	2,732	2,718	2,539	2,211
Special Shedding (including seeds, models, &c.) . . .	2,771	2,553	2,902	2,878	2,692	2,351	2,428	2,197
<b>TOTAL . . .</b>	<b>14,772</b>	<b>12,200</b>	<b>15,491</b>	<b>15,532</b>	<b>13,930</b>	<b>12,597</b>	<b>13,402</b>	<b>13,018</b>
<b>No. of Implement Stands . . .</b>	<b>412</b>	<b>395</b>	<b>502</b>	<b>489</b>	<b>450</b>	<b>393</b>	<b>442</b>	<b>408</b>

<sup>1</sup> Including 52 entries of goats in 1897, and 14 in 1892.

have been fewer, and those of cattle more numerous, the last Yorkshire Meeting, held at Doncaster in 1891. The increase of pigs was due to the operation of the Swine regulations of the Board of Agriculture (see Appendix, p. 100). The space allotted to implements was above the average of recent years.

# 1883 AND 1900—A COMPARISON.

The totals of entries at the last two York Meetings are given in the table below. The largest increase in the livestock section in 1900 was under the head of sheep. No provision was made for poultry in 1883.

## *Comparison of Entries at the Two York Meetings, 1883 and 1900.*

Section	1883	1900	Increase (+) or decrease (−) in 1900
Cattle	611	696	+ 85
Sheep	462	687	+ 225
Pigs	412	614	+ 202
Poultry	200	—	− 200
Implements	—	629	+ 629
Other	125	528	+ 403
Grand total stands . . .	401	412	+ 11

A more detailed comparison of the entries at the two meetings of 1883 and 1900 is afforded by the table on p. 409. It is seen that the total prize-money offered for livestock, and produce this year amounted to 6,620*l.*, or about 10 per cent. more than in 1883. The only noteworthy difference in the livestock section is the greater sub-division of the pony classes, provision made for Polo ponies this year. The Long-ear, Highland, Guernsey, Kerry, and Dexter breeds of Cattle were placed assigned to them in the Catalogue of 1883. The Kentish, Devon Longwoolled, Somerset and Dorset Herdwicks, and Welsh Mountain breeds of Sheep were absent in the earlier year. A coincidence that established a pleasant link between the two York Meetings may be found in the circumstance that Mr. S. P. Foster, who was Steward of Live Stock in 1883, officiated again in that capacity in 1900.

The Produce section in 1883 comprised merely two classes. There was one for a half-hundredweight of Yorkshire Cheese

of any make, and the other for six pounds of Butter. This year's classes are referred to in detail at p. Hives and Honey were represented in 1883, but not Cider Perry.

In the Implement Department in 1883 a prize of 50 offered, and awarded, for the best equipped dairy, suitable not more than twenty cows. Nine Silver Medals were awarded for new implements; they were given for (1) butter worker table combined, (2) straw trussing machine, (3) straw yeast machine, (4) steam plough, (5) wire rope for steam cultivator, (6) horse hoe, (7) corn screen, (8) threshing machine dredger.

At this year's Meeting two Silver Medals were awarded for appliances which are described in the Report at p. There were also trials of horse-power cultivators (see p. 461), self-moving steam diggers (see p. 443), and mowing machines (see p. 466). A prize of 20*l.* was offered for shearing machines to be driven by power other than horse power, and a prize of 10*l.* for sheep shearing machines driven by hand power. The Judges in this competition submitted the following report:—

In reporting upon the Sheep Shearing Machines at York, we were disappointed at the shortness of Entries, only three Exhibitors competing—namely, Messrs. Burdon & Ball, Ltd., Sheffield; Messrs. Burdett & Sons, Ltd., Birmingham; and the Barton-Gillette Horse-Clipping Sheep-Shearing Co., Ltd., London.

After carefully examining and testing the three machines used by us we had no hesitation in awarding the prize to No. 4783 (Barton-Gillette) on account of the simplicity of construction and working power placing it considerably ahead (at any rate, from a farmer's point of view) of any other exhibited. This machine was exhibited last year at the Maidstone Meeting, where it received the award of a Silver Medal.

The ingenious arrangement of the chain gear, so well protected by flexible wire-tubing, does away with any inconvenience in using the machine.

Although the actual time taken for the shearing of a sheep exceeds a few seconds that of other machines, the bruising and snipping were less, this latter being a great consideration.

With regard to the hand power machines, we do not think their acquisition, as they require two men to do the work of one, and even they entail very hard work for the one at the wheel, either by hand or treadle. In our opinion, the principal value of Sheep Shearing Machines is that several can be worked on the same shafting, and thus, when shearing is done on a large scale, a great saving of time and labour is effected.

### THE SHOW.

The Implement Yard alone, including the Dairy, was open to the public on Saturday, June 16. At the Dairy Miss H. commenced a series of demonstrations which were repeated



each day of the Show. The judging of the produce classes—butter and cheese, cider and perry—took place on this day, when the awards were published.

Divine Service was, as usual, held in the large tent on the Show Ground on Sunday morning. The sermon was preached by the Bishop of Richmond (the Right Rev. John J. Pulleine, D.D.) from the text, St. John vi. 12—"That nothing be lost."

Monday was an exceedingly busy day. The Stewards and the Judges of live stock assembled in the large tent at 8.30 A.M., where they were briefly addressed by Mr. Percy Crutchley, the Honorary Director. Judging commenced at once in the various stock rings and elsewhere, but it was not till a late hour in the evening that the final awards were announced. On this and the following days the milking machines entered for competition were shown at work. There were also commenced the lectures on bee management and demonstrations of bee driving.

The Prince of Wales, as President of the Society, visited the Show on Tuesday, and presided at the General Meeting of Governors and Members, a report of which is given in the Appendix (p. civ.). The Duke of York was also present, and their Royal Highnesses remained on the ground many hours, and inspected nearly every department of the Exhibition. In the Great Ring a morning parade took place of cattle and heavy horses, followed by an afternoon parade of hunters, hackneys, and other light horses; these parades were repeated on the succeeding days. On Tuesday and each subsequent day the band of the Queen's Own Yorkshire Dragoons played selections of music, the programme of which was printed in the Catalogue.

Thursday was in many respects the most interesting day of the Meeting, for the Show was graced by the presence of the Prince and Princess of Wales, the Princess Victoria of Wales, and the Duke of York. Their Royal Highnesses, who met with a most cordial greeting from visitors to the Show, were received by the Honorary Director and the Council, who had assembled in front of the Royal Pavilion at the middle of the Showyard. After witnessing a parade of prize animals and the judging of Draught Horses (which took place on this day), and inspecting some of the principal features of the Show, the Royal party drove away, having been on the ground nearly three hours.

#### THE WEATHER.

A considerable quantity of rain had fallen in the neighbourhood up to the eve of the Show, but the opening day (Saturday)

hot and brilliant throughout. This type of weather continued till Monday, the heat of the greater part of that day excessive. As the afternoon advanced the sky clouded and there was a rapid decline in temperature that proved acceptable after the sweltering heat. The succeeding days all bright and pleasant, the more so that whilst there were of rain every night there was genial sunshine in the intervening hours during which the Show was open. Few Meetings, indeed, have been better favoured in the matter of weather.

### THE ATTENDANCE.

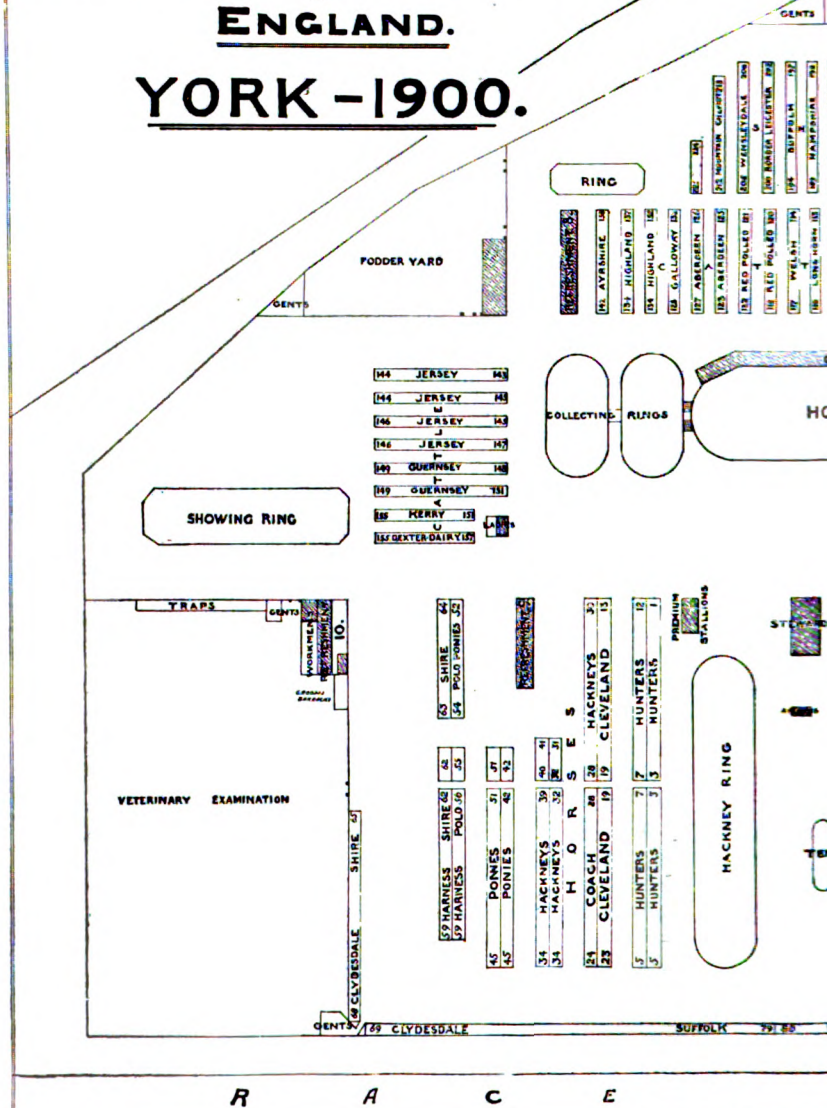
The Show was accompanied by all the features that are generally regarded as sufficient to ensure a large attendance of the general public. York is one of the most conveniently accessible of railway centres, and there is a very large population within moderate radius. The Showyard was at an easy distance from the railway station, and that important element of success was on its best behaviour. Withal, however, the aggregate attendance, amounting, as shown in the subjoined table, to 87,511, must be pronounced as most disappointing. With the exception of the total at the Maidstone Meeting in the preceding year, the York total is the lowest recorded since the Reading Meeting in 1882. During the last 40 years—since 1860—there have only been eight Meetings at which the aggregate number of visitors was less than at York. The number of people who paid for admission on the two half-crown days numbered only 23,665, a total less than that recorded on one of the half-crown days at Darlington in 1895. Again, the total attendance of 87,511 at York fell short of the number on one day alone of the Nottingham Meeting in 1888, when 88,832 people paid for admission on the first shilling day. The number of people who paid one shilling for admission at York numbered

### Table of Paying Visitors at the last Ten Country Meetings (1891–1900).

Year	York, 1900	Maidstone, 1899	Birmingham, 1898	Manchester, 1897	Leicester, 1896	Darlington, 1895	Cambridge, 1894	Chester, 1893	Warwick, 1892	Doncaster, 1891
2s.6d.)	157	183	256	—	173	574	260	299	266	344
1s.)	2,233	1,050	2,462	4,547	1,801	2,172	1,879	2,397	3,570	2,621
1s.6d.)	11,333	8,928	10,492	22,418	17,409	12,046	13,152	20,959	16,598	12,331
1s.)	12,332	8,572	22,317	21,473	21,735	24,942	17,890	19,034	15,779	18,530
1s.6d.)	52,488	35,249	49,011	73,119	80,602	43,073	63,981	59,555	36,448	57,580
1s.)	8,968	14,594	13,735	73,802	24,558	17,603	14,496	13,664	23,801	20,034
Total	87,511	68,676	98,277	217,980 <sup>1</sup>	146,277	100,310	111,658	115,908	96,462	111,500

<sup>1</sup> Including 22,621 on the sixth day (1s.).

# YORK-1900.





61,456, a total which falls below that recorded on only one of the shilling days at Cambridge in 1894, at Leicester in 1895 and at Manchester in 1897. It should be mentioned that the Yorkshire Agricultural Society, instead of joining hands with the Royal Agricultural Society, as on former occasions, held its annual show at Doncaster, a few weeks after the York Meeting. The attendance at Doncaster, however, like that at York, was disappointing.

#### EXHIBITION OF ZEBRA HYBRIDS, &c.

At this stage, reference may appropriately be made to the display of Zebra Hybrids, &c., sent—for exhibition only—by Professor J. Cossar Ewart, F.R.S., who himself kindly attended and was unwearied in his efforts to afford to the visitors inspected the display any information they sought, though they were greatly helped by an illustrated handbook.<sup>1</sup> The bearing of Professor Ewart's investigations upon the questions that confront the stock breeder added much to the practical interest of the display. It seems desirable to print here the list of exhibits, the numbers denoting the order in which they were severally met with in making the tour of the building that was erected for their accommodation. Professor Ewart's explanatory notes to the various exhibits convey a clear idea of the problems upon the solution of which he is engaged.

1. **VALDA**, a chestnut polo pony, and her zebra hybrid foal born May 12, 1900. *Sire*, the Burchell zebra MATOPO (No. 33).

Foals are born with long legs, because to have a chance of surviving in a wild state they must from the first be able to keep pace with the troop to which they belong. This hybrid, born a few minutes after birth, was capable of following his dam and her. Ordinary foals are at birth often awkward and ready to follow a moving object, but hybrids are from the first on the alert and easily separated from their respective dams.

The stripes in **BIRGUS** are nearly as distinct as in a zebra, but, as in all the hybrids bred, the body colour is darker than in zebras. Instead of agreeing in their plan and number with the stripes in Burchell zebras the markings in **BIRGUS** follow the stripes in the Imperial zebra. Further, the mane in **BIRGUS** beyond the withers agrees with Grevy's zebra rather than with the Burchell zebra sire.

2. **NESTOR**, a zebra hybrid, one of twins, born May 31, 1900. *Dam*, Valda (No. 1) ; *Sire*, Matopo (No. 33).

<sup>1</sup> *Guide to the Zebra Hybrids, &c.*, on exhibition at the Royal Agricultural Society's Show, York, together with a Description of Zebras, Hybrid Zebras, &c. By J. COSSAR EWART, M.D., F.R.S., Regius Professor of Natural History, University of Edinburgh. With numerous illustrations. Edinburgh: printed by T. & A. Constable, 1900. Price 1s.

The twins (one of which died at birth) were smaller and less distinctly marked than their full brother Birgus (No. 1). NESTOR, delicate for some weeks after birth, is now relatively small; he moves more like a stag than a colt or a young zebra.

**BLACK AGNES**, born June 23, 1898, is the second hybrid out of LADY DOUGLAS, a 15-hands bay cart mare, by MATOPO (No. 33).

The first hybrid (Brenda) is more strongly built than her sister. In colour Brenda resembles their common dam. BLACK AGNES (No. 3) takes after one of her maternal ancestors. It is not a little remarkable that MATOPO (No. 33) seems as incapable of handing on his light body colour as he is of transmitting his own special pattern of stripes.

**TOR**, the third foal of VALDA (No. 1), born June 7, 1899, a year after the twin hybrids. Sire, Lockstitch, a chestnut thoroughbred horse.

**RONA**, the second foal of VALDA, a 14.3 bay Irish thoroughbred mare. Sire, MARS ROYAL, a bay hackney pony.

Rona, when still under three years of age, had a zebra hybrid by Matopo. Neither Hector (No. 4) nor Argo (No. 5) affords any evidence in support of the widespread belief that a mare throws back to a previous sire.

Lord Morton's famous chestnut mare, after producing a hybrid to a quagga, had three foals to a black Arabian horse. All three foals presented stripes more or less distinct across the shoulders. These striped "colts" led many to adopt the old "infection" or "throwing back" belief—to believe in what we now call Telegony.

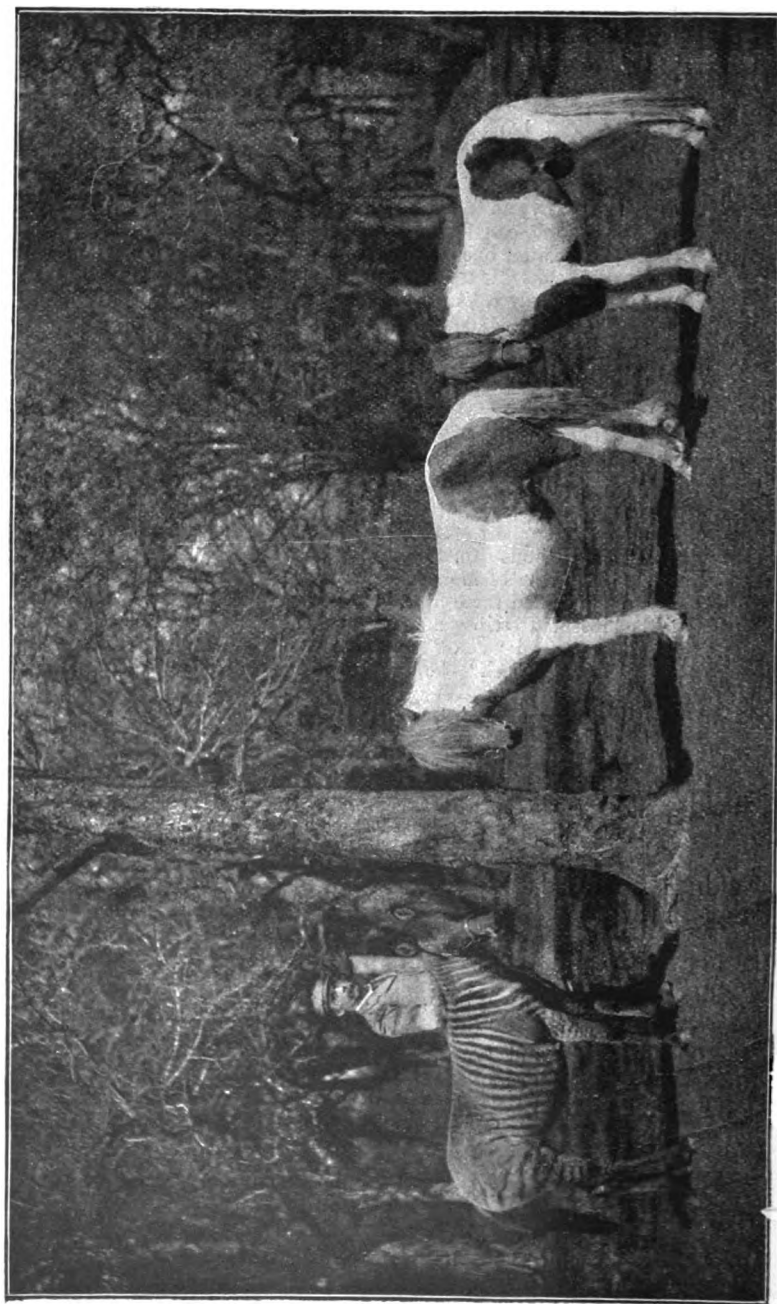
As already indicated, there is no evidence Valda (No. 1) was "infected" by producing twins to the zebra, or that Rona, the dam of Argo (No. 5), was "infected." Neither has Lady Douglas, the dam of the hybrids Brenda and Black Agnes (No. 3), been in any way influenced. In April 1900 she had a foal to Mars Royal, the sire of Argo (No. 5), which in no single point in any way suggests the previous sire Matopo.

Professor Coasar Ewart has seen horses as richly striped as the "colts" produced by Lord Morton's mare, hence he thinks it is more than probable that the seven-eighths chestnut Arabian mare would have had striped foals to the black Arabian horse, even if she had never seen a quagga.

**JOHN**, a zebra hybrid, born June 11, 1899. Sire, MATOPO (No. 33); Dam, TUNDRA, a skewbald Iceland pony (fig. 1).

SIR JOHN (fig. 1) is interesting, because in his colouration he is probably a wonderfully accurate reproduction of the primeval horse—of the striped ancestor of both horses and zebras.

Khaki-coloured ponies partially striped are not uncommon in the out-of-the-way places. Recently a pony from Thibet was described as extensively covered over with zebra-like markings. It had a black stripe down the spine, broad black stripes over the shoulders, flanks, and legs, and dappled spots over the haunches. It may be mentioned that Sir John is even more difficult to see by our moonlight than his zebra sire Matopo; he would, however, be more easily seen in the bright moonlight of South Africa.



"Sir John."

"Tundra."

FIG. 1.

"Circus Girl."

the skin of **HECLA**, a zebra hybrid, full sister of Sir John (No. 6), born May 22, 1897.

Hecla died 90 days after inoculation with the Tsetse disease organism : a large cart horse inoculated at the same time died on the eighth day. Had the poison been less virulent, or had Hecla been inoculated soon after birth, she might have survived. Hecla is much darker than Sir John. In the case of Lady Douglas, the second hybrid is darkest in colour.

**CIRCUS GIRL**, a half sister of **SIR JOHN** (No. 6) and Hecla (No. 7). *Dam*, Tundra ; *Sire*, a bay Shetland pony.

In no respect does Circus Girl (fig. 1) support the belief in Telegony, but being in her make, colour, gait and disposition a faithful reproduction of her dam, she proves that the sire sometimes counts for nothing in the offspring.

tailless half-wild **RABBIT**.

When tame white and wild grey rabbits are crossed, the young are always grey, but when two half-wild grey rabbits are interbred the young usually vary amazingly. In the litter to which this specimen belonged the following colours were represented : white, yellow, black, brown and chinchilla. With rabbits, as with other animals, the first cross may give uniform results, but subsequent crossing often leads to an epidemic of variation.

quarter-wild **DOE RABBIT** and four young by a black and white buck.

The black and yellow members of the litter are specially interesting. A black variety of the wild rabbit is common. Occasionally there are yellow or sand-coloured wild rabbits, and near Dublin, in a small nearly isolated area, a yellow variety of the variable hare abounds.

three **RABBITS**, members of one litter ; one reproduces the dam, one the wild grandsire, and one the Himalaya great grandmother.

**WHITE CAT** and her four kittens.

The sire of the kittens is pure white, he is a full brother of the dam. Two kittens, one male and one female, resemble the parents ; while two, one male and one female, take after the great grandmother.

photograph of a small black and tan **SPANIEL** and her lemon-coloured pup.

The pup has reverted to the lemon-coloured ancestors of his lemon and white pointer sire.

photograph of a "Calico" or "Painted" **MULE**, imported from Chicago, and now the property of Mr. Barrett, Bromley, Kent.

A spotted zebra hybrid would be remarkable enough, but in some respects a spotted mule is still more remarkable. In this case the dam (a Pinta or Indian pony) has almost entirely controlled the development—in most cases mules resemble the sire more than the dam. Two years ago Professor Ewart bred a hinny, which, unlike most hinnies, is more an ass than a horse. Many other instances might be given to show that either parent

(regardless of its sex) may be prepotent, and determine the character of the offspring.

15 to 32. These exhibits were all pigeons.

33. **MATOPPO**, a Burchell zebra (Chapman variety) from the border of the Transvaal, is the sire of all the hybrids on view. Though conspicuous enough by daylight, Matopo (fig. 2) is practically invisible by moonlight at a distance of fifty yards, and in a bright starlight night he is invisible, with the exception of his legs, at four or five yards.

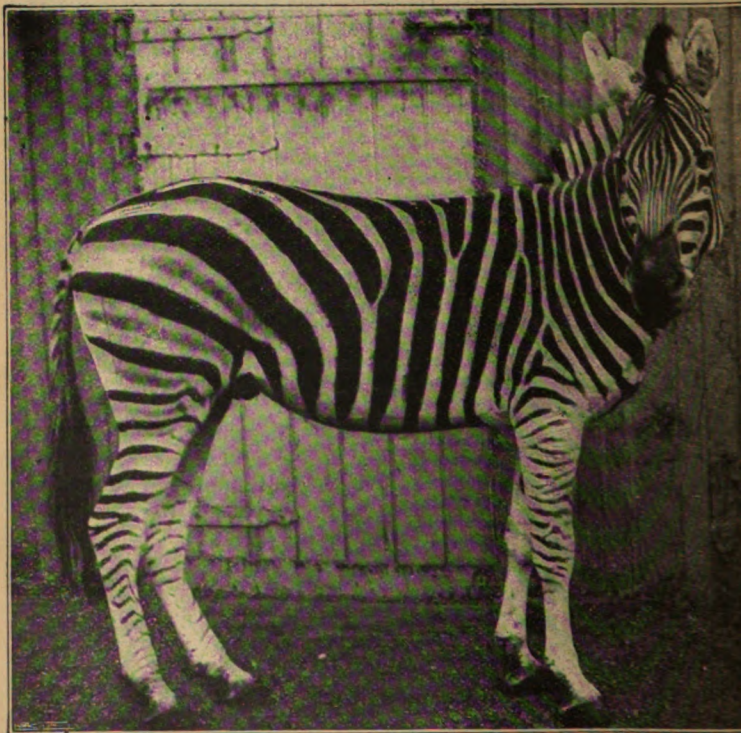


FIG. 2.—“Matopo,” a Burchell Zebra.

In the pointed brow arches, the great, oblique bar across the hind quarters, Matopo differs very decidedly from

<sup>1</sup> The following Zebra Hybrid Foals by Matopo were exhibited :  
 Out of *Valda* (No. 1)—**BIRGUS** (No. 1) and **NESTOR** (No. 2).  
 Out of *Lady Douglas*—**BLACK AGNES** (No. 3).  
 Out of *Tundra*—**SIR JOHN** (No. 6); see also Nos. 7 and 8.  
 Out of *Mulatto*—**ROMULUS** (No. 37).  
 Out of *Nora*—**NORETTE** (No. 40).  
 Out of *Biddy*—**REMUS** (No. 41).

the Imperial zebra, and also from his hybrid offspring. Except when herding mares he is wonderfully quiet and friendly.

OF A GREVY'S ZEBRA (*Equus grevyi*), obtained by Alfred L. Pease, Esq., M.P., Pinchinthorpe, Yorkshire.

Though sometimes over 15 hands and very profusely banded, Grevy's zebra (which may be known as the Imperial zebra) is, in at least the arrangement of its stripes, more primitive than the much smaller and less richly-decorated Burchell zebra of South Africa. Two Imperial zebras from Shoa (a gift from the Emperor Menelik to Her Majesty the Queen) are now living in the Zoological Gardens, London.

OF A BURCHELL ZEBRA from British East Africa.

In the Imperial zebra there are over forty pairs of stripes running outwards from the dorsal band between the withers and the root of the tail. In the typical Burchell zebras there are usually only four or five transverse stripes, the flanks, croup, and hind quarters being crossed by broad oblique bands. Further, in the Imperial zebra the face is decorated with numerous narrow stripes, which form arches on the forehead. In the Chapman and certain other members of the Great Burchell group the facial stripes unite to form a few pointed brow arches.

OF A YOUNG BURCHELL ZEBRA from British East Africa.

The stripes, except in the region of the neck, are light in colour, and the hair, especially over the croup, is long and wavy—in the adult Imperial zebra the hair is extremely short, and it is oval in section.

MATOPO (No. 33), the sire of the hybrids on view, belongs to the Chapman variety of the Burchell group of zebras.

ROMULUS, a zebra hybrid, born August 12, 1896. Sire, Matopo; Dam, Mulatto, one of Lord Arthur Cecil's Island of Rum ponies (fig. 3).

Baron de Parana, of Brazil, having satisfied himself that a cross between a male Burchell zebra and an ordinary mare had never been bred, began experiments in breeding zebra hybrids in 1892. His first hybrid was born in December 1896, a few months after the arrival of Romulus. Baron de Parana, who has considered zebra hybrids mainly from a utilitarian point of view, has come to the conclusion that they will be the mules of the twentieth century. Zebra "mules" suitable for heavy transport work will, Professor Ewart believes, be best obtained by crossing carefully-selected mares with the Imperial zebra (*E. grevyi*) of Somaliland. But no attempt, as far as he knows, has yet been made to cross the horse with the Somaliland zebra.

ROMULUS, strong and hardy, was easily broken to harness. He moves, as the make of his legs suggests, more like a zebra than a horse. Though somewhat restless when separated from his companions, he is quiet and easily controlled. It is doubtful if he will ever prove fertile.

At birth the body colour of ROMULUS varied from orange to reddish brown, but since his first coat was shed it has varied from a leather to a mouse dun.

38. **MULATTO II.**, half-sister of Romulus (No. 37) bred at Kn Kent, by Lord Arthur Cecil. *Sire*, Loch Korrie, a Highland pony; *Dam*, Mulatto.

In 1897 Mulatto had a foal by a grey Arab (Benzarek) she missed having a foal in 1898. **MULATTO II.** (No. 38) foaled in May 1899. Both Mulatto's subsequent foals faintly striped at birth, but in both the stripes vanished as first coat was shed. As the foals of two other ponies of Mul strain (ponies that never even saw a zebra) were as richly striped as Mulatto II., there is no reason for assuming the faint markings on the "subsequent" foals were in any way due to Mulatto having been infected by her first sire, the zebra.

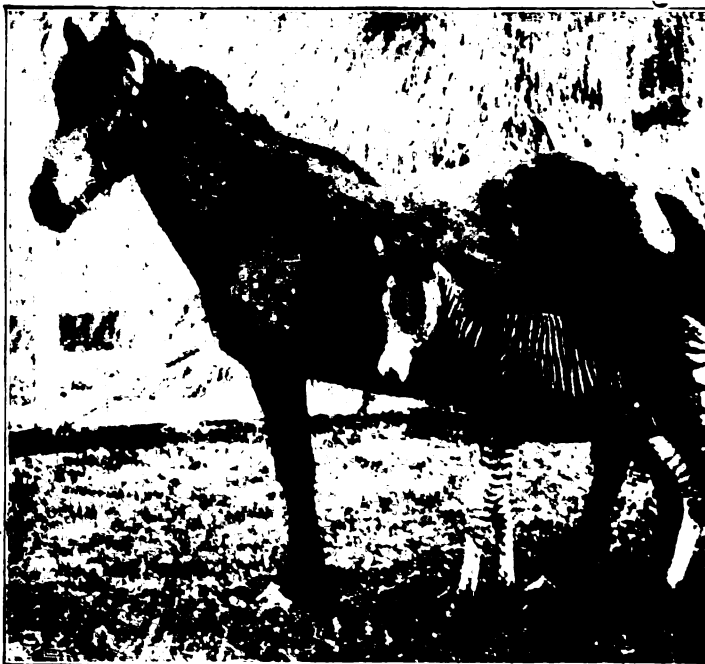


FIG. 3.—"Mulatto" and "Romulus," the latter at seven days old.

39. **SKUA**, the third foal of **NORA**, a black 11-hands Shetland pony. *Sire*, a bay Welsh pony.

In 1895 Nora had a foal to a Shetland stallion ("Walla" which was as richly striped as one of the pure-bred foals of Lord Morton's mare; in 1897 she had a hybrid by Mulatto (No. 33), and in 1898 she produced Skua (No. 39), which in any way ever suggested a zebra. Hence, Nora, before ever seeing a zebra, had a somewhat zebra-like foal, then a zebra hybrid (NOBETTE, No. 40), and then a foal (SKUA, No. 39), which, though cross-bred, never presented a vestige of a stripe.

40. **NORETTE**, a zebra hybrid, born June 8, 1897. *Sire*, Matopo (No. 33); *Dam*, Nora, the black Shetland pony referred to under No. 39.

**NORETTE** (fig. 4), except in colour, is extremely like a zebra. This is probably due to Nora counting for little or nothing in her offspring, to her want of character or prepotency. In **ROMULUS** (No. 37) the croup was spotted at birth, in **NORETTE** (No. 40) it has from the first been crossed by numerous zigzag bands, thus differing decidedly from the croup of Matopo (No. 33). In her face markings she also differs greatly from her sire.

41. **REMUS**, a zebra hybrid gelding, born May 18, 1897. *Sire*, Matopo (No. 33); *Dam*, **BIDDY**, a 14-hands bay Irish roadster.

**REMUS** is nearly intermediate between a horse and a zebra, he moves well, and promises to be faster than **Romulus** (No. 37).

42. **KATHLEEN**, half sister of **Remus**, born May 6, 1898. *Sire*, Tupgill, a thoroughbred chestnut horse; *Dam*, **BIDDY**, the bay Irish mare referred to under No. 41.

In no single point has **KATHLEEN** ever suggested a zebra. The same is true of **Biddy's** third foal by "Gold," a chestnut hackney horse.

43. **FATIMAH**, an Arab filly, bred and presented by Wilfred Scawen Blunt, Esq., of Crabbet Park, Sussex.

It has often been assumed that Arabs were never striped. This filly, an Arab of the purest blood, has a dorsal band, distinct bars on both fore and hind legs, and vestiges of shoulder-stripes. Had **KATHLEEN** (No. 42), or any of the "subsequent" foals on view, presented as many stripes as this Arab filly, many would have considered that the fact of Telegony had been fully established. In **FATIMAH** we have simply an instance of reversion to the striped ancestor of all the horses.

44. **DRAWINGS** to illustrate some of the earlier stages in the development of the horse.



FIG. 4.—"Norette" in summer coat. The mane, with the exception of a few long tufts, is short and upright.

The opinions of the Judges in the various departments of the Exhibition are quoted in, or embodied with, the notices which follow. The names of the Stewards and Judges, together with the full official List of Awards, printed at p. cix. of the Appendix. As this list supplies essential particulars concerning the ownership, breeding, and parentage of the prize animals, it is unnecessary to repeat the text.

### HORSES.

The entries of horses, numbering 696, might well have reached a larger total at a Yorkshire Meeting. They far exceeded the 713 at Doncaster in 1891, the 981 at Manchester in 1897, and the 709 at Birmingham in 1898. As is usually the case, the Hunters were present in strongest force, as may be seen from the Table below. The influence of locality is the circumstance that Hackneys rank second numerically, displacing the Shires from a position they not infrequently occupy, and relegating them to the third place. To this influence is attributable the large entry of Cleveland Bay Coach Horses, aggregating 105. The results of the veterinary inspection are reported at p. xc. of the Appendix.

#### *Entries of Horses at the last Five Country Meetings, 1896-*

	York, 1900	Maldstone, 1899	Birmingham, 1898	Manchester, 1897
PRIZES OFFERED	£2,505	£1,835	£2,416	£3,588
Hunters . . . . .	No. 154	No. 50	No. 157	No. 197
Hacks . . . . .	3	—	—	—
Cleveland Bays . . . . .	42	19	22	23
Coach Horses . . . . .	63	18	18	17
Hackneys . . . . .	115	55	103	183
Ponies . . . . .	41	20	42	79 <sup>1</sup>
Mountain and Moor- land Ponies . . . . .	11	11	23 <sup>1</sup>	—
Polo Ponies . . . . .	41	47	69	95
Shetland Ponies . . . . .	11	21	—	—
Pit Ponies . . . . .	—	—	—	—
Harness Horses and Ponies . . . . .	31	34	40	73
Shires . . . . .	76	90	135	172
Clydesdales . . . . .	30	27	34	51
Suffolks . . . . .	45	42	39	44
Rulley Horses . . . . .	—	—	—	—
Draught Horses . . . . .	33	8	27	47
Agricultural Geldings . . . . .	—	—	—	—
<b>Total Entries of Horses</b>	<b>696</b>	<b>424</b>	<b>709</b>	<b>981</b>

<sup>1</sup> Including Shetland Ponies.

## LIGHT HORSES.

**Hunters.**—The 12 classes provided in this section attracted a total of 154 entries, or an average of nearly 13 each. The largest was Class 4, Hunter mare or gelding (12 to 15 stones), with 33 entries. Dealing first with the heavy-weight Hunters in Classes 1, 3, 5, 6, 7, and 8, Class 1 consisted of two good mares, and the Judges "regret that the number is short, specially as Yorkshire is supposed to have a reputation for breeding Hunters." Class 3 produced, in its first prize winner, a horse of great merit and excellent manners. Class 5 throughout was exceptionally good, and Class 6 fairly so. Class 7 contained several very valuable young horses, but Class 8 was only moderate. Of the light-weight Hunters, Class 2 was of fair quality, with three good prize winners. Class 4 was good, "but the margin of weight (12 to 15 stones) made it difficult for the Judges to award prizes satisfactorily, being too great." Classes 9 and 10 were both good, the latter especially so as regards the first two fillies. Classes 11 and 12, on the other hand, were poor, the latter in particular.

**Hacks.**—Only two were shown, both being good. The Judges think "it is to be regretted that a class of animal now in such request should be so badly represented."

**Cleveland Bays.**—The 42 entries were accommodated in eight classes, the largest of which was Class 15 (stallion foaled in 1898), with nine entries, whilst Class 18 (gelding foaled in 1899) attracted only one entry. Three-year-old stallions (Class 14) made a small but good class, the winner, Mr. H. C. Stephens's *Wellington*, being "an extraordinarily grand horse," to which the stallion championship was awarded. The two-year-old stallions (Class 14) furnished a good entry and a most creditable class, the placed ones well deserving their position. The brood mares (Class 16) were thoroughly representative of the breed, with quality and action much in evidence, thus showing the result of careful and judicious breeding. The gelding classes (17 and 18) were small but satisfactory. The two- and three-year-old fillies (Class 19) were most excellent, and the winner, Mr. H. C. Stephens's *Cholderton Darling*, was selected as the female champion. The yearling colts (Class 20) proved to be a level good lot, and the yearling fillies (Class 21) compensated for their smallness in numbers by their quality and action.

**Coach Horses.**—To these, as to the Cleveland Bays, eight classes were assigned, but the total entries, numbering 63, were half as many again as the Clevelands. Class 25, with 14 entries, was the best filled. The Judges report as follows :—

CLASS 22 (three-year-old stallions).—The placed horses were fairly good, the others not very creditable.

CLASS 23 (two-year-old stallions).—Very similar in merit to Class 22.

CLASS 24 (mares).—Few in numbers, but good in quality.

CLASS 25 (three-year-old geldings).—A good entry of average merit.

CLASS 26 (two-year-old geldings).—A small entry of moderate animals.

CLASS 27 (fillies).—This was the best class in the section.

CLASS 28 (yearling colts).—Many creditable exhibits were shown.

CLASS 29 (yearling fillies).—A small entry, moderate.

As a whole the Coach Horses were average.

The champion prizes were awarded to Mr. John White's stallion *Master John* (Class 22) and Mr. John Scaife's mare *Queen Anne* (Class 24).

**Hackneys.**—In this section 115 entries were distributed over 14 classes, the largest of which was Class 30 (stallion, foaled in 1897, fifteen hands and upwards) with 20 entries. The champion stallion was Sir Walter Gilbey's *Bonny Danegelt*, and the champion mare Mr. Harry Livesey's *Orange Blossom*, the latter thus repeating her victory of last year. The class prizes awarded numbered 32, and they were participated in by the produce of 20 different sires. The most successful of these is *Polonius*, with three first prizes and one third to his credit. *Garton Duke of Connaught* ranks next with two firsts, one second, and two thirds, and is followed by *Rosador* with two firsts and one third, and by *Connaught* and *Royal Danegelt*, each with one first and one second. Five sires figure in the list for one first prize each—*Anconeus 2nd*, *Chocolate Junior*, *His Majesty*, *Romeo 3rd*, and *Royal Dane*. One second prize each stands to the credit of *Astwick Surprise*, *Clovelly*, *Danger*, *Ganymede*, *Langton*, *Prince Alfred*, *Prince Henry 3rd*, and *Ritualist*; and one third prize each to the credit of *Diviner* and *Hedon Swell*. Subjoined is the Judges' report:—

The mare classes were good, but small in number, the older animals being much superior to the young stock.

The stallion classes, though better filled, were rather lacking in quality, though the winners were in most cases animals of considerable merit.

The riding classes were bad—except the first and second prize winners in each class.

**Ponies.**—Forty-one entries occupied four classes, which were almost uniformly filled. The Judges say:—

We were much disappointed with the Hackney Pony Classes 44 to 47, as throughout the whole of these classes the ponies were decidedly short of action, and the general quality was not up to what we have been accustomed to see at the Royal.

**Shetland Ponies, and Mountain and Moorland Ponies.**—A class for stallions and a class for mares were provided for each

of these sections, respecting which the Judges report as follows :—

The number of Shetland ponies exhibited in the two classes was very limited, comprising only four stallions and six mares. The quality throughout was excellent, the special feature being the uniformity of type in the exhibits and the entire absence of those nondescripts which their owners conclude must be Shetlanders because they are small.

The uniformity, type, and high quality of the ten ponies exhibited in this section would compare favourably with the same section of any show in our experience.

In the Mountain and Moorland section the number of exhibits was equally disappointing, without the same uniformity of type or merit. Among the three stallions exhibited the winner, a grey Welsh mountain pony, was conspicuously first, and a really good pony. The second prize was awarded to a useful pony of New Forest type. In a class of eight mares, the first three were good specimens of Welsh mountain, while the fourth, larger and stronger, was from the New Forest. It is to be regretted that the Exmoor, Dartmoor, and Cumberland breeds were conspicuously absent from both classes.

**Polo Ponies.**—The entries numbered 41, and of the six classes the best filled was Class 57 (colt, gelding, or filly, foaled in 1899), which attracted 10 entries. The champion prize for the best stallion was awarded to Sir Walter Gilbey's *Rosewater*. The following is the report of the Judges:—

The Polo Pony classes as a whole were satisfactory both as regards the improvement shown over past years and the average quality of the exhibits. We note more particularly that the brood mares are of the true Polo Pony type. The winner was a very high class mare.

In the classes for young stock we note that breeders have succeeded—and especially in the two-year-old and yearling classes—in producing, in our opinion, animals likely to grow into really high class Polo ponies.

We regret that in the class for Polo stallions the competition remains so limited. The stallions shown are, however, excellent in quality, notably *Rosewater*, *Gownboy*, *Sandway*, and *Mootrub*.

**Harness Horses and Ponies.**—The 31 entries occupied three classes, the largest being Class 59 with 13 entries. The Judges say:—

In Class 58 (mare or gelding, of any age, above 15 hands) only three exhibits came before us, and with the exception of the winner there was nothing of much merit.

Class 59 (mare or gelding, of any age, above 14 and not exceeding 15 hands) was particularly good, all of those awarded cards being of exceptional merit.

Class 60 (mare or gelding, of any age, not exceeding 14 hands) was moderate.

**Thoroughbred Stallions.**—The winners of the three Queen's Premiums of 150*l.*, awarded in 1900 by the Royal Commission on Horse Breeding, for Thoroughbred Stallions serving mares during the season of 1900, in District E, Yorkshire, were

exhibited, not for competition, in a special shed. They were *Cyclops*, *Imprévu*, and *Toboggan*. See Appendix, p. cxiii.

### HEAVY HORSES.

**Shires.**—There were 76 entries, in seven classes, the best filled being Class 67 (yearling fillies) with 16 entries. The champion prizes went to Lord Llangattock's stallion *Hendre Hydrometer* and Sir J. Blundell Maple's filly *Victor's Queen*. The class prizes awarded numbered 20, and these were well distributed amongst the produce of 17 different sires. *Bury Victor Chief* and *Markeaton Royal Harold* are each represented by one first prize and one second; *Harold* by one second and one third. One first prize each stands to the credit of *Prince Harold*, *Prince William*, *Regent 2nd*, *Seldom Seen*, and *Waresley Triumph*; one second prize each to that of *Calwich Heirloom*, *Norman Conqueror*, *Southgate Honest Tom*, and *Whaplode Flower*; and one third prize each to that of *Dunsmore Masterman*, *Honest Tom*, *Jeroboam*, *Lockinge Albert*, and *Marmion 2nd*. Subjoined is the Judges' report:—

CLASS 61 (three-year-old stallions).—Quality good, especially the first and second prize horses.

CLASS 62 (two-year-old stallions).—This class contained many good horses, especially the winner of the first prize; his feet were good, with good flat bone. This horse was awarded the champion medal for the best Shire stallion.

CLASS 63 (yearling stallions).—This class, with the exception of the first and second prize winners, was hardly up to the standard for quality. The first prize colt showed exceptional merit.

CLASS 64 (mares).—This class, as were all the classes for females, was better represented both in quantity and quality than the male classes. The first prize mare was a really good animal, and was placed reserve for the champion medal. The foals in this class were not good. The second prize mare was little inferior to the first.

CLASS 65 (three-year-old fillies).—This was a specially good class, but some of the best-looking animals failed to pass the veterinary examination. The first prize filly showed great merit, and was awarded the champion medal for mares or fillies. The second filly was also very good.

CLASS 66 (two-year-old fillies).—This class contained many good animals, especially the first and second, there being very little between the two in point of merit.

CLASS 67 (yearling fillies).—This class, with the exception of the first prize winner, was hardly equal to the three-year-old and two-year-old fillies.

**Clydesdales.**—Thirty entries were distributed over six classes, the largest being that for two-year-old fillies (Class 73) with nine entries; this proved to be the most uniform class that passed before the Judges.

**Suffolks.**—Forty-five entries were contained in six classes,

gest being Class 79 (two-year-old fillies) with 11 entries. Judges make the following report:—

have pleasure in stating that the Suffolk horse classes as a whole, being the long distance from home, showed up in good numbers and in good form, not an animal being disqualified by the veterinary in-

three classes for stallions contained 18 entries. Some very promising ones before us, likely to maintain the reputation of the breed.

Three classes for mares and fillies were even better filled, and contained many good specimens. The competition in these classes was very keen, some of the winners showing exceptional merit. We are glad to note that while the attendance at the York Meeting in 1888 numbered 26, this year no less than 1000 were recorded.

**Bought Horses.**—The six classes in this section attracted many entries. The largest class was that for three-year-old geldings (Class 81) with 12 entries. Subjoined is the re-

s 80 (four-year-old geldings).—A very good class, the first prize being specially good, with the best of feet and legs. The winner of the second prize was little inferior to the first.

s 81 (three-year-old geldings).—This class was very well represented. The first and second prize horses were, however, greatly superior to the remainder.

s 82 (agricultural pairs).—A very grand pair of geldings won the first prize.

s 83 (railway or corporation horses).—This class was poorly represented, which is to be regretted; the winners, however, were really good.

s 84 (tradesmen's heavy or rulley horses).—A good entry, and containing many excellent animals.

Judges were greatly pleased to find so few unsound animals, and evidently show greater attention is being paid to breeding horses with sound constitutions and legs.

## CATTLE.

There exists a long-standing rivalry between the Shorthorns and the Jerseys for the premier position numerically. Last year at Maidstone the Jerseys headed the list. This year, as seen in the Table on p. 428, the Shorthorns take the lead, and indeed they should at a Yorkshire Meeting. The Jerseys, though only about half as many as the Shorthorns, are well represented in the list. Aberdeen Angus cattle were present in good numbers, a strong force, and the large entry of Highland cattle was noteworthy. Ayrshires were weak, and the small Irish cattle were below their average numbers.

**Shorthorns.**—The 162 entries were distributed amongst many classes, the largest being that for yearling bulls (Class 88), which attracted 41 entries. The champion bull was *Royal*, exhibited by Her Majesty the Queen, whilst the champion

cow was Mr. W. J. Hosken's *Countess of Oxford* 14th. The Judges make the following report:—

**CLASS 86** (bulls calved in 1896 or 1897).—There were 16 entries in this class, and 15 entered the ring. Although not up to the high standard of the Royal generally, there were several meritorious animals, as to whose quality it was difficult to specify any great difference. Especially was this so with regard to the three prize animals.

**CLASS 87** (two-year-old bulls).—A large and exceedingly good class, including the champion and reserve in the male section. Ten or twelve entries were fine specimens.

**CLASS 88** (yearling bulls).—A large class, and difficult to judge owing to the variety of types. There were some entries of only medium quality. Three or four of the best were of nearly equal merit.

**CLASS 89** (cows).—A remarkably good class, amongst which were at least half a dozen very superior animals. The first prize cow was also awarded the champion prize for the best female.

**CLASS 90** (three-year-old heifers).—This class included a better lot than is usually seen at the Royal. The first prize animal was reserved for the championship.

**CLASS 91** (two-year-old heifers).—There were in this class 18 entries, and the judges spent much time in arriving at their decision. The first prize animal far excelled any of her competitors.

**CLASS 92** (yearling heifers).—A very large and good class. It included eight or ten really good animals.

*Entries of Cattle at the last Five Country Meetings, 1896–1900.*

	York, 1900	Maldstone, 1899	Birming- ham, 1898	Manchester, 1897	Leicester, 1896
PRIZES OFFERED	£1,755	£1,770	£1,716	£2,105	£1,656
	No.	No.	No.	No.	No.
Shorthorns . . .	162	128	188	184	127
Herefords . . .	56	57	60	60	47
Devons . . .	23	35	38	51	26
Sussex . . .	25	68	28	25	27
Longhorns . . .	8	9	22	—	—
Welsh . . .	23	18	21	32	23
Red Polled . . .	34	33	27	38	28
Aberdeen Angus . . .	63	46	56	46	31
Galloways . . .	24	15	24	29	22
Highland . . .	40	—	—	3	6
Ayrshires . . .	9	13	19	21	7
Jerseys . . .	121	143	168	149	130
Guernseys . . .	65	67	79	61	46
Kerries . . .	9	11	18	17	14
Dexters . . .	14	16	22	27	17
Dairy Cattle . . .	11	24	32	78	43
Total Entries of Cattle	687	683	792	821	594

**Herefords.**—There were 56 entries in seven classes, but Class 96, for cows, was vacant, and the largest class was that for yearling bulls, in which there were 23 entries. Of aged bulls

(Class 93) there were only two entries, but the Judges found both possessed of very special merit. Two-year-old bulls (Class 94) were an exceedingly good class, so good indeed that the Judges commended the whole. The yearling bulls (Class 95) were a very meritorious lot, whose high quality throughout did credit to the breed. Much difficulty was felt in placing the first two animals. Of three-year-old heifers (Class 97) only three were shown, but they were all of very great merit; the same remarks apply to the two-year-old heifers (Class 98). Yearling heifers (Class 99) were a beautiful lot, and here again it was a very close run between the first and second prize winners. The Judges add:—

We consider that the Herefords as a whole were shown in very creditable numbers considering the distance from Herefordshire, and the merit throughout is fully as high as has been seen of recent years. More attention is being paid to scale and lean flesh.

**Devons.**—The six classes attracted 23 entries. The largest classes were the cows (Class 102) and yearling heifers (Class 105), each with five entries. The aged bulls (Class 100) were of excellent quality, the first and second prize animals possessing remarkable merit. Class 102 contained a very superior selection of cows, the quality being so excellent that some difficulty was felt in the adjudication. The three-year-old heifers (Class 103), though very good, were not quite up to the standard of the preceding class. The two-year-old heifers (Class 104) were very satisfactory. The yearling heifers (Class 105) formed perhaps the best female class in the section, and here again great difficulty was experienced in awarding the prizes. Of the Devons as a whole the Judges say:—

We are sorry to note the small number of entries in this section; but, considering the distance of this year's Show from their native country, this is not to be wondered at.

**Sussex.**—There were 25 entries amongst five classes, the best filled being Class 106 (old bulls) and Class 110 (yearling heifers), each with six entries. The old bulls (Class 106) were of good size and quality, and possessed of typical characteristics. The yearling bulls (Class 107) were not a strong class in either numbers or quality. In Class 108 (cows or heifers, calved in 1894, 1895, 1896, or 1897) three good animals competed. Of two-year-old heifers (Class 109) there were but two specimens, which were fairly good. Only three of the yearling heifers (Class 110) came forward, and the quality was poor. The report concludes as follows:—

The Judges regret that a better show of the Sussex breed was not

forthcoming, the exhibits being short in numbers, and the quality and style not equal to that seen in former years. Many entries were not forthcoming.

**Longhorns.**—Eight entries comprised two of bulls (Class 111) and six of cows (Class 112). The latter were good, several animals showing the true characteristics of the breed; the whole class was commended.

**Welsh.**—There were 23 entries, very uniformly distributed over five classes. Taken as a whole, the Judges considered that the cows (Class 115) made the best class in this section, but they found the Welsh cattle throughout, though not numerous, to be of very superior quality and of more than ordinary merit.

**Red Polled.**—Thirty-four entries were fairly uniformly distributed amongst five classes. The old bulls (Class 118) were a good lot, the first two being of exceptional merit, and including the male champion, Mr. James E. Platt's *Champion*. The yearling bulls (Class 119) were all of good merit. Cows (Class 120) made a very good lot, amongst which the Judges found the female champion, Lord Amherst of Hackney's *Charmante*. In a nice lot of two-year-old heifers (Class 121) were one or two animals of great merit; the yearling heifers (Class 122) were also good. The Judges add :—

We consider this section a good one in point of quality, although the breed was not very strongly represented in numbers.

**Aberdeen Angus.**—There was a creditable total of 63 entries, the largest of the five classes being that for yearling heifers (Class 127) with 16 entries. The champion animal was Mr. W. S. Adamson's *Diaz*. The Judges report as follows :—

While the entries of Aberdeen Angus Cattle were, we believe, more numerous than at any former meeting of the Society, it is pleasing to state that the average quality of the exhibits was decidedly high, with an entire absence of anything approaching inferiority.

The aged bulls, the cows, and both classes of heifers were exceptionally good, the winning animal in each case being a beautiful specimen of the breed.

The Polled Cattle Society's gold medal for the best animal of the breed was awarded to the first prize winner in the class of older bulls, one of the best specimens of this famous beef breed that has appeared for many years.

**Galloways.**—The two dozen entries were identical with the Birmingham total two years ago. They were very evenly distributed over the five classes. The aged bulls (Class 128) were all of good merit. The cows and heifers were generally satisfactory. The Judges add :—

The Galloways, though not as numerous as could have been wished, form a very creditable representation of the breed.

**Highland.**—A remarkably large entry of 40 animals was accommodated in five classes, the best filled of which was Class 136, for cows, with 12 entries. The champion prizes were awarded to the Earl of Southesk's bull *Laoich* and Mr. T. V. Smith's heifer *Cruinneag 6th of Ardtornish*. Subjoined is the Judges' report:—

Seeing that York is situated so far from the native districts of the Highland breed of cattle, the display of stock was quite surprising. All the different classes were well represented, and the quality all over was superior.

The first lot that came under our observation were the cows, and the prize winners among them would take leading honours in any show of the United Kingdom. In the next class that was presented to us, viz, three-year-old heifers, was found the female champion, and a more complete specimen of a Highlander in our opinion could not be produced.

In the male classes the quality was all that could be desired. The first and second prize animals in the aged class are very noted specimens of the breed. The same remark will apply to the first prize two-year-old bull, and to the first and second prize yearling bulls.

**Ayrshires.**—The four classes attracted only nine entries. The two bull classes had a solitary occupant each. The Judges found the Ayrshires as a whole, though few in numbers, yet of excellent quality.

**Jerseys.**—The 121 entries were below the average total of recent years. Of the five classes the largest was Class 146, two-year-old heifers, with 30 entries. The following is the report of the Judges:—

The Jersey classes as a whole were exceedingly well filled, and, with the exception of that for two-year-old heifers, of high average merit. There were many good animals in the old bull class, though some otherwise good specimens lost place by the faulty position of their false teats. A very strong class of yearlings was headed by one of exceptional merit.

Of the many strong classes, that for cows bred in 1894, 1895, 1896, or 1897, was easily the best. It contained several animals, any one of which would have made a creditable first prize winner, and as a class was of far more than average merit. The two-year-old heifer class contained a few specimens of great excellence, but, as a whole, was the poorest of the five classes. The yearling heifers made a good display both in numbers and quality.

The Judges were agreeably surprised to find such strong classes at a show held so far north as York.

**Guernseys.**—This breed was represented by 65 entries, and the largest of the five classes was that for cows (Class 150) with 14 entries. The old bulls (Class 148) included many animals of exceptional merit. Amongst the yearling bulls (Class 149) were several good youngsters. The cows (Class 150) were exceedingly good. Two-year-old heifers (Class 151) were a strong lot. The Judges state that the classes throughout were well filled, and the cattle sent forward in good form.

**Kerries.**—The nine entries were below the average; they comprised four in the male class and five in the female class. Though small in numbers, the Kerries were good in quality and true to type. The champion prize was awarded to Messrs. Robertson & Sons' cow, *La Mancha Fan*.

**Dexters.**—The 14 entries in this section were also below average; there were six in the male class and eight in the female class. The bulls included one of the best the Judges had ever seen, Messrs. Robertson & Sons' *La Mancha Union Jack*, to which the champion prize was awarded. The female class contained some very good animals.

**Dairy Cattle.**—There was only one class on this occasion, with eight entries, and the cows were judged by inspection.

### SHEEP.

The Shropshires, temporarily displaced at Maidstone last year by the Southdowns, reasserted their numerical superiority at York. The Hampshire Downs rank third, which is creditable when their distance from the place of meeting as compared with that of the Lincolns and Leicesters is taken into consideration. The influence of locality is shown in the relatively large entries of Black-faced Mountain and Cheviots, but a better muster of Herdwicks might have been looked for. Details as to other breeds are supplied in the Table on p. 433 opposite.

**Leicesters.**—The entries, numbering 41, were about an average; they were drawn from seven different flocks. In the two-shear rams (Class 158) quality was lacking, except in the case of the first two. The first prize ram, Mr. George Harrison's, is a very fine specimen of the breed, to which the champion prize was awarded. The shearlings (Class 159) were weak, and included some very moderate sheep. Ram lambs (Class 160) were a nice lot. Shearling ewes were good both in numbers and in quality, several pens possessing high merit. Ewe lambs (Class 162) made a small class of average quality.

**Cotswolds.**—Twenty-two pens were entered from three separate flocks. The report of the Judges states:—

The classes of Cotswold sheep were filled as well as usual, the two-shear ram and yearling class being represented by very useful sheep. The shearling ewes were a grand lot, many pens showing excellent type and characteristics of the breed. The pens of ram and ewe lambs were good. The breed wants to be more generally known, and used for especially crossing purposes.

**Lincolns.**—The entry of 56 pens was not quite up to the average total of the preceding three or four years. Eleven

flocks were represented. The champion prize went to Mr. Henry Dudding's shearling ram. The Judges say:—

We consider the show of Lincolns very good both as to numbers and quality of the exhibits. The first prize two-shear ram is a magnificent specimen of his class, combining wool, quality, and mutton, as also is the first prize shearling; and, in awarding the champion to the shearling, we consider him the best specimen of the breed that has been exhibited for some years. The class of pens of five specially deserve mention, the majority of the exhibits being particularly good. The shearling ewes are also of special merit. The section taken altogether is very good indeed.

*Entries of Sheep at the last Five Country Meetings, 1896–1900.*

	York, 1900	Maldstone, 1899	Birming- ham, 1898	Manchester, 1897	Leicester, 1896
PRIZES OFFERED	£1,365	£1,410	£1,275	£1,275	£1,291
	No. of Pens	No. of Pens	No. of Pens	No. of Pens	No. of Pens
Leicesters . . .	41	30	35	60	42
Cotswolds . . .	22	21	32	21	20
Lincolns . . .	56	61	75	73	50
Oxford Downs . . .	35	31	44	27	28
Shropshires . . .	105	103	147	141	127
Southdowns . . .	79	114	84	74	64
Hampshire Downs . . .	64	66	59	58	60
Suffolks . . .	32	44	13	18	23
Border Leicesters . . .	53	24	36	61	42
Somerset and Dorset Horned . . .	6	4	6	10	7
Kentish or Romney Marsh . . .	18	86	27	19	23
Wensleydales . . .	35	12	18	21	14
Devon Longwooled . . .	8	11	—	—	—
Cheviots . . .	17	8	8	8	7
Black-faced Mountain . . .	23	9	12	19	12
Lonks . . .	—	—	6	7	4
Herdwicks . . .	6	2	6	15	10
Welsh Mountain . . .	14	5	16	17	18
<b>Total Entries of Sheep</b>	<b>614</b>	<b>631</b>	<b>624</b>	<b>649</b>	<b>551</b>

**Oxford Downs.**—Thirty-five entries represented nine flocks. Two-shear rams (Class 174) were of fair average merit. The shearling rams (Class 175) included sheep of very considerable size and quality. The pens noticed by the Judges amongst the ram lambs (Class 176) contained strong and well-grown animals. The prize pens of ewes (Class 177) were of first-class size, quality, and colour, and were highly creditable to the breed.

**Shropshires.**—A total entry of 105 pens represented 22 flocks. The two-shear rams (Class 179) made a fair entry of useful sheep. The shearling rams (Class 180) were strong in numbers, and included many good specimens of the breed. Amongst the

pens of five shearling rams (Class 181) were many animals of considerable merit. Of the ram lambs (Class 182) the first prize pen was exceptionally good, and several other pens contained lambs of great promise. The shearling ewes (Class 183) were very strong, and the competition was remarkably keen. The ewe lambs (Class 184) made another strong class, well filled.

**Southdowns.**—The entry of 79 pens represented 16 separate flocks. The champion award went to Mr. C. R. W. Adeane's two-shear ram in Class 185. Amongst the shearling rams (Class 186) some of the exhibits outside the prize pens were lacking in quality, size, and character. Shearling ewes (Class 188), though not numerically strong, made up a class calling for high commendation.

**Hampshire Downs.**—There was a full average entry of 64 pens, drawn from 14 distinct flocks. The two-shear rams (Class 190) included a number of good animals. The true Hampshire type was well in evidence in the shearling rams (Class 191), which included Lord Rothschild's champion ram. The ram lambs (Class 192) were satisfactory, and there was strong competition for the premier award. The ewes (Class 193) were good as usual. The ewe lambs (Class 194) made probably the best class in the section.

**Suffolks.**—Thirty-two pens were entered from eight different flocks. The champion gold medal was awarded to the Earl of Ellesmere's shearling ram, and the Judges doubt if ever a better specimen of the breed has been exhibited. They add:—

The Suffolk sheep judged by us at the York Meeting were, on the whole, an improvement on former exhibitions at the Royal Show. Some of the classes were short in numbers, but there were some fine specimens of the breed in every class of both ewes and rams. A great improvement has been made by breeders of Suffolk sheep in the type and quality of the animals.

**Border Leicesters.**—A strong entry of 53 pens was contributed from 12 flocks. Two-shear rams (Class 200) were very good, whilst the shearling rams (Class 201) were regarded by the Judges as the best class ever seen at the Royal Show. Ram lambs (Class 202) and ewes (Class 203) were good all round, whilst the ewe lambs (Class 204) were satisfactory considering the time of year.

**Wensleydales.**—The 35 entries were much above the average in number; they came from six separate flocks. Two-shear rams (Class 205) were very good, and included the champion, shown by the executors of the late Mr. T. Willis. Shearling rams (Class 206) were also very good, and difficulty was

experienced in deciding the positions of the first two. Ram lambs (Class 207) were fairly good. Shearling ewes (Class 208) made a splendid class, of which the Judges had seldom seen the equal. The ewe lambs (Class 209) made a fairly good class.

**Kentish or Romney Marsh.**—The 18 pens represented five flocks. The shearling rams (Class 210) were of not quite so good quality as usual, and no sheep stood clearly ahead of the others. The shearling ewes (Class 211) were decidedly better.

**Devon Longwooled.**—Two flocks contributed a total of eight entries, seven of which were placed by the Judges.

**Somerset and Dorset Horned.**—Six pens were entered from two flocks, and the Judges noticed them all, as they found the quality in each class excellent, especially amongst the ewes.

**Cheviots.**—Seventeen entries were made from three flocks. The Judges report a small but good show of Cheviot sheep, the shearling rams (Class 217) in particular being good.

**Black-faced Mountain.**—The 23 pens in this section were from seven separate flocks. The old rams (Class 216) made a fairly good class. The shearling rams (Class 217) were a level lot, with nothing outstanding amongst them. Gimmers (Class 218) made a good show.

**Herdwicks.**—The section comprised one ram and two pens of ewes, the latter of useful breeding type.

**Welsh Mountain.**—Fourteen pens came from six separate flocks. The rams (Class 224) were an excellent lot, and the pens of ewes (Class 225) well deserved the prizes awarded to them.

#### POULTRY, INCLUDING DUCKS, GEESE, AND TURKEYS.

The marked decline in the number of poultry entered at Maidstone last year was accentuated at York, where the aggregate of 629 was the lowest of the decade. As is seen in the Table below, the decline was mainly in the entries of Fowls:—

#### *Entries of Poultry at the last Five Country Meetings, 1896–1900.*

	York, 1900	Maidstone, 1899	Birmingham, 1898	Manchester, 1897	Leicester, 1896
<b>PRIZES OFFERED</b>	<b>£274</b>	<b>£268 10s.</b>	<b>£257</b>	<b>£257</b>	<b>£245</b>
	No.	No.	No.	No.	No.
Fowls . . . . .	499	552	768	691	701
Ducks . . . . .	57	56	84	84	80
Geese and Turkeys . . .	42	27	55	42	42
Table Poultry . . . .	31	34	67	50	78
<b>Total Entries of Poultry</b>	<b>629</b>	<b>669</b>	<b>964</b>	<b>867</b>	<b>901</b>

The entries at York included the following totals:—

Game . . . . .	61	Orpington . . . . .	47	Hamburgh . . . . .	13
Dorking . . . . .	70	Houdan . . . . .	16	Any other recog-	
Brahma and		French (except		nised breed . . . . .	18
Cochin . . . . .	33	Houdan) . . . . .	13	Table Poultry	
Langshan . . . . .	30	Minorca . . . . .	28	(pairs) . . . . .	24
Plymouth Rock . . . . .	58	Leghorn . . . . .	38	Table Ducklings	
Wyandotte . . . . .	71	Andalusian . . . . .	13	(pairs) . . . . .	7

**Poultry.**—*Game* birds were strong in the old classes, but weak in the young ones. *Dorkings* showed a great improvement on last year, and many excellent specimens were exhibited. *Brahma* and *Cochin* were good in the older classes, but cockerels and pullets were poor. *Langshans* were satisfactory in all classes. *Plymouth Rocks* made a good show, the birds in the younger classes being very forward. *Wyandottes* were well represented; as a whole the cocks were superior to the hens, but the pullets, particularly the silver laced, were more forward in feather than the cockerels. *Orpington* cocks and hens made capital classes, and the younger classes were commendable. *Houdan* cocks were good, and hens were better, but the chicken classes were disappointing. Of *French* (any variety except *Houdan*) three varieties were penned, each getting a prize. *Minorca* classes were well filled, and contained some typical specimens, good in all points. *Leghorns* were hardly so numerous, but the chicken classes were very good, and included birds of much promise. Of *Hamburghs* all the five varieties were represented. *Any other variety* classes contained excellent specimens of some of the oldest breeds.

**Ducks.**—The entries consisted of 23 *Aylesbury*, 15 *Rouen*, 6 *Pekin*, 7 *Cayuga*, and 6 of any breed (except *Aylesbury*). *Aylesbury* classes were in fair condition for the season, and the young birds well forward. *Rouen* drakes were not a good lot, but the ducks made a better entry, and were fair in quality. *Pekins* were badly represented. *Cayuga* drakes were good, but ducks poor. *Any breed* classes were small, and the specimens fair.

**Geese.**—The entries comprised 12 *Embsden* and 10 *Toulouse*. *Embsdens* were most creditable and *Toulouse* were good.

**Turkeys.**—The 20 entries included 10 cocks and 10 hens. The classes were very superior, and of special merit.

**Table Poultry.**—The Judge of this section sends the subjoined report:—

The number of entries in the Table Poultry section was not what might have been expected, especially in the cross-bred classes. The total entries were 31—namely, 24 couples of fowls and seven couples of ducks, of which two lots of fowls and one lot of ducks were absent. In quality the birds were

better than last year, but in a number of cases were rather coarse in skin. This, however, is inseparable from the plan of showing the birds alive first. I carefully looked over them with a view of seeing if any were old, but did not find that this was so. As usual, the birds were shown alive on the Monday, and killed and plucked on the evening of that day. This work was carried out by Messrs. Timothy Newby & Sons, of Boar Lane, Leeds, and was excellently done.

The pure-bred classes were the best in number; but I was sorry to see that in several of the birds bent breast-bones were very much in evidence. In the cockerel class the winners were Buff Wyandottes, which variety can never be regarded as first-class table fowls, because of their yellow skin and legs; but in this case they were decidedly the best. The second prize was given to Plymouth Rocks, very neat and fairly well fleshed; and third were Dark Faverolles, long-bodied, but rather coarse in skin. The dead weights of the respective birds in this class were as follows:—

2596 (3rd prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 13 \text{ oz.} \\ 5 \text{ lb. } 10 \text{ oz.} \end{array} \right.$	2599 (reserve)	$\left\{ \begin{array}{l} 4 \text{ lb. } 3 \text{ oz.} \\ 4 \text{ lb. } 13 \text{ oz.} \end{array} \right.$
2597	$\left\{ \begin{array}{l} 4 \text{ lb. } 6 \text{ oz.} \\ 4 \text{ lb. } 15 \text{ oz.} \end{array} \right.$	2600	$\left\{ \begin{array}{l} 3 \text{ lb. } 9 \text{ oz.} \\ 2 \text{ lb. } 15 \text{ oz.} \end{array} \right.$
2598 (1st prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 15 \text{ oz.} \\ 4 \text{ lb. } 9 \text{ oz.} \end{array} \right.$	2602 (2nd prize)	$\left\{ \begin{array}{l} 3 \text{ lb. } 11 \text{ oz.} \\ 3 \text{ lb. } 8 \text{ oz.} \end{array} \right.$

In the pullet class the winners were a very nice pair of Golden Wyandottes, wonderfully delicate in flesh for what is not regarded as a first-class table fowl. Second were Buff Orpingtons, good colour of flesh, white legs, but lean. The dead weights were as follows:—

2603 (1st prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 5 \text{ oz.} \\ 4 \text{ lb. } 2 \text{ oz.} \end{array} \right.$	2604 (2nd prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 0 \text{ oz.} \\ 4 \text{ lb. } 4 \text{ oz.} \end{array} \right.$
2605 (reserve)			$\left\{ \begin{array}{l} 3 \text{ lb. } 2 \text{ oz.} \\ 3 \text{ lb. } 3 \text{ oz.} \end{array} \right.$

The Indian Game and Dorking crosses did not make nearly so good a display as we have seen of late years, especially in the cockerel classes, where no first prize was awarded, and the quality was not at all high. The dead weights in this class were as follows:—

2606 (reserve)	$\left\{ \begin{array}{l} 5 \text{ lb. } 9 \text{ oz.} \\ 5 \text{ lb. } 6 \text{ oz.} \end{array} \right.$	2607 (2nd prize)	$\left\{ \begin{array}{l} 5 \text{ lb. } 3 \text{ oz.} \\ 5 \text{ lb. } 4 \text{ oz.} \end{array} \right.$
2608 (3rd prize)			$\left\{ \begin{array}{l} 4 \text{ lb. } 9 \text{ oz.} \\ 4 \text{ lb. } 9 \text{ oz.} \end{array} \right.$

The pullets were distinctly better, the first prize especially being very good in quality and excellent in colour. The dead weights were as follows:—

2609	$\left\{ \begin{array}{l} 3 \text{ lb. } 10 \text{ oz.} \\ 3 \text{ lb. } 14 \text{ oz.} \end{array} \right.$	2611 (1st prize)	$\left\{ \begin{array}{l} 3 \text{ lb. } 12 \text{ oz.} \\ 4 \text{ lb. } 4 \text{ oz.} \end{array} \right.$
2610 (3rd prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 0 \text{ oz.} \\ 3 \text{ lb. } 12 \text{ oz.} \end{array} \right.$	2612 (reserve)	$\left\{ \begin{array}{l} 3 \text{ lb. } 10 \text{ oz.} \\ 3 \text{ lb. } 6 \text{ oz.} \end{array} \right.$
2618 (2nd prize)			$\left\{ \begin{array}{l} 3 \text{ lb. } 8 \text{ oz.} \\ 3 \text{ lb. } 6 \text{ oz.} \end{array} \right.$

The Any Other First Crosses had only one lot in each class, both of these being between the Indian Game and Buff Orpington, which is a promising cross, although these specimens were a little hard. The dead weights were as follows:—

Cockerels: 2614 (2nd prize)	$\left\{ \begin{array}{l} 4 \text{ lb. } 12 \text{ oz.} \\ 4 \text{ lb. } 2 \text{ oz.} \end{array} \right.$
Pullets: 2615 (2nd prize)	$\left\{ \begin{array}{l} 3 \text{ lb. } 11 \text{ oz.} \\ 3 \text{ lb. } 14 \text{ oz.} \end{array} \right.$

The Any Other Cross classes brought out the real novelty of the display. In the cockerels the first prize pair were between Indian Game and Sussex, and the reserve between Wyandotte and Redcap, and the first-prize in the pullet class was of the latter cross also. The pullets were wonderfully delicate and a very nice pair, although I cannot quite understand their having white legs, because the cockerels of the same cross had yellow legs, as one would expect. I must point out, however, that the birds exhibited in this class ought to have been transferred to Classes 240 and 241, as they were first crosses. The dead weights were as follows:—

Cockerels: 2617 (reserve)	. . . . .	{ 8 lb. 14 oz.
		{ 4 lb. 13 oz.
Cockerels: 2618 (1st prize)	. . . . .	{ 5 lb. 1 oz.
		{ 5 lb. 8 oz.
Pullets: 2619 (1st prize)	. . . . .	{ 8 lb. 2 oz.
		{ 8 lb. 3 oz.

The Table Ducklings made a very nice display in the pure-bred class, all of which were Aylesburys. The first prize were beautiful specimens in the very pink of condition, one being especially a remarkable bird and well fed. The dead weights were as follows:—

2620 (3rd prize)	. { 5 lb. 6 oz.	2622 (2nd prize)	. { 5 lb. 4 oz.
	. { 5 lb. 1 oz.		. { 5 lb. 1 oz.
2621 (1st prize)	. { 5 lb. 7 oz.	2623 (reserve)	. { 8 lb. 5 oz.
	. { 5 lb. 7 oz.		. { 6 lb. 0 oz.
2624	. . . . .		{ 3 lb. 9 oz.
			{ 3 lb. 5 oz.

In the cross-bred class only one lot was shown, to which third prize was given. This cross was not stated, and it is desirable in all the crosses that the parents should be declared. The dead weights were as follows:—

2626 (3rd prize)	. . . . .	{ 8 lb. 10 oz.
		{ 8 lb. 11 oz.

### DAIRY PRODUCE.

The entries of Butter were about an average, but those of Cheese, though larger than at Maidstone last year, were decidedly below the average of recent years. Details are furnished in the subjoined Table:—

#### *Entries of Produce at the last Five Country Meetings, 1896–1900.*

	York, 1900	Maidstone, 1899	Birmingham, 1898	Manchester, 1897	Leicester, 1896
PRIZES OFFERED	£293	£539	£252	£406	£309
	No.	No.	No.	No.	No.
Butter . . . . .	168	121	225	187	141
Cheese . . . . .	84	74	120	195	153
Cider and Perry . . . . .	107	104	112	89	95
Hops . . . . .	—	62	—	—	—
Preserved Fruits and Vegetables } . . . . .	—	6	—	—	—
Hives and Honey . . . . .	169	258	178	244	185
Total Entries of Produce.	528	625	635	715	574

**Butter.**—This was shown in four classes. In Class 346, for kegs of butter delivered on May 5, there were 15 entries. The class was of fair average quality for long-keeping butter, and the first and second prize lots were excellent. In Class 347, for boxes of twelve 2 lb. rolls, made with not more than 1 per cent. of salt, the entries numbered 23, and included some very good butter. There was a marked difference in the packing, and this the Judges took into consideration in making their awards. Class 348, for fresh butter slightly salted (68 entries), was decidedly the best of the butter classes, notwithstanding that some of the samples were inferior and badly packed. Class 349, for fresh butter, slightly salted, made from milk of cows other than Channel Islands, or cows crossed with Channel Islands breeds, attracted 62 entries. It was a disappointing class, the texture and flavour being very much below the standard; only two of the four first prizes offered were awarded.

**Cheese.**—Twelve classes were provided, all for cheese made in 1900. *Cheddar* (11 entries) made an excellent class, and with one exception the whole class might have been commended. *Cheshire* (13 entries) was, with the exception of the four prize lots, of lower quality than might have been expected, there being a tendency to too quick ripening, and in consequence a prevalence of taints. The first prize was given to a lot which, though not quite ripe, will develop into a first-class long-keeping cheese, which is what the trade requires. *Stilton* (8 entries) included some excellent exhibits, which, of course, were unripe so early in the season. *Wensleydale*, *Stilton* shape (8 entries), was on the whole a disappointing class, some of the exhibits having a very bad flavour. The first prize lot, however, was excellent, and possessed true flavour and texture. *Wensleydale*, flat shape (6 entries), made a very poor class, in which the first prize was withheld, and some difficulty was felt by the Judges in awarding even the second. *Cleveland*, *Stilton* shape (9 entries), made a very even class of good quality throughout. The cheeses, however, were exhibited in too new a state, as was the case also in the otherwise good class of *Cleveland*, flat shape, with 7 entries. *Ryedale*, though a small class of 4 entries, was of very good quality. *Double Gloucester* (3 entries) showed excellent quality in the prize cheeses, and this was also the case with the *Wiltshire* class of 3 entries.

#### CIDER AND PERRY.

A total of 107 entries in this section was rather above the average. In Class 362, for cider in cask, made in the autumn

of 1899, there were 26 entries. Class 363, for bottled cider made in the autumn of 1899, was the largest class, with 42 entries. Class 364, for bottled cider made before 1899, attracted 17 entries. In Class 365, for bottled perry, the entries numbered 23. The Judges make the following report :—

Class 362.—We consider this, taking it altogether, to be a very good class. Most of the exhibits were too sweet for immediate drinking, but this no doubt is due to the character of the apple vintage of last year, when, owing to the excess of sun heat in the summer and autumn, the fruit ripened unusually well, and consequently developed in the juice a large amount of sugar.

Class 363.—This was a large class but a disappointing one. After the character of the vintage of last year above-mentioned, a much finer quality of cider in bottle might have been expected.

Class 364.—This class was short in entries and poor in quality, and did not include any sample of special merit.

Class 365.—We are glad to say that this was an exceptionally good class, and contained so many entries of merit as to occasion considerable difficulty in making the awards.

### HIVES, HONEY, &C.

Two dozen classes were provided in this section, and attracted altogether 169 entries, a total below the average. Subjoined is the Judges' report :—

The classes in this department maintain the degree of improvement which has been noticeable year by year since scientific bee-keeping has received encouragement from the Council. The comparatively early date on which the Show is annually held somewhat militates against very numerous exhibits of honey of the current year's gathering, and when to this is added such a backward spring as that of 1900, it is gratifying to find the allotted space nicely filled with honey of all-round excellence.

The seven entries in Class 366, "Collections of Hives and Appliances," show that finality has not been reached, for each year brings distinct improvements on its predecessors in the finish and workmanship of the exhibits.

Class 367, "A Beginner's Outfit," for 30s. is a marvel of cheapness.

Class 368, "Observatory Hive," this year gives us a much more rigid and safely handled hive, having a new and cleanly method of supplying the bees with food in adverse weather.

Classes 369 and 370, "Unpainted Hives." Here we find the reputations of our best makers well maintained by 21 entries, most of which are made of close-grained, well-seasoned white pine-wood, fastened together with oval-shaped steel wire nails, which give a maximum of holding power and strength with a minimum of weight.

Class 371, "Honey Extractor," needs no comment beyond commendation for the good workmanship of the prize-taker.

Class 372, "Useful Appliance introduced since 1898." A new invention, enabling the bee-keeper to cast his beeswax into cakes of 2, 4, 8, or 16 oz., well deserved the prize it got.

s 373, "Sections of Comb Honey of year 1900." We are now face with the results of a cold, wet spring, and find more honey than anticipated. The quality, though good, was not of a high

s 374, "Sections of 1899 Honey," should have drawn more entries, not remarkable in any way.

s 375, "Sections of Heather Honey of any year," brought 9 entries, particularly good honey, the prize-takers being perfect samples, dropping in numerical order in the question of flavour.

s 376, for combs of honey in shallow frames, needs no remark.

s 377 to 379, for run or extracted honey, light, medium, and colour (30 entries), brought into further prominence the unfavouring weather experienced by the bee-keeper.

s 380, 381, and 382, for honey of 1899, gave us some fine samples and kept flavour wonderfully well.

s 383, a tasteful trophy or display of honey not to exceed in height 4 feet above the table, was, as is always the case, a great attraction to the department with its five entries.

s 384 not remarkable.

s 385 showed some admirable examples of how to get up beeswax for the retail trade.

Classes 386, honey vinegar, 387, mead, 388 and 389, instructive of practical and scientific nature, there is nothing special to say.

23 classes judged show that bee-keeping is keeping pace with the wonderful advances made in Scientific Agriculture we see every year parts of the Show-ground.

### HORSE-SHOEING COMPETITIONS.

These contests, open to shoeing-smiths in any part of the Kingdom, were held at the Shoeing Forge, Class I. being on the Tuesday and Class II. on the Wednesday. The results may be said to be as follows:—

As regards the shoeing work, as a whole, the shoeing work has been exceedingly good and the men examined have shown a fair knowledge of the structure of the foot, and the general principles of shoeing.

Class I (Hunters). Out of 15 entries, 14 men competed. Although the number was small, considering the high character of the work, we were able to award all the six prizes authorised and two "Highly Commended."

Class 2 (Cart Horses). Out of 40 entries there were 39 competitors. As regards the excellence of the work done, in addition to the six prize medals we have "highly commended" five and "commended" four.

We have pleasure in recommending the winner of the first prize in each class to the Freedom of the Guild of the Worshipful Company of

When Candidates for registration were examined, and two reached the required standard.

A lecture, amply illustrated by specimens, was delivered at the Shoeing Forge on the Thursday by Mr. John Malcolm, F.V.S., on "The Horse's Foot and How to Shoe it." It was attended by a large and attentive audience.

## CONCLUSION.

The York Meeting of 1900 will be remembered not only for the exceptionally fine weather which accompanied it, but also for the honour conferred upon the Society by the Royal visits on two days of the Exhibition. It afforded the Members the greatest satisfaction to be able to renew to the Princess of Wales their loyal and respectful greetings on the occasion of Her Royal Highness's again gracing their Showyard with her presence, after an interval of some years.

The keen interest which the Prince of Wales has always taken in Agriculture was evidenced by the considerable time His Royal Highness devoted to the Show, and by the following valedictory letter addressed by the Royal President to the Secretary :—

Marlborough House, Pall Mall, S.W.  
July 6, 1900.

DEAR SIR ERNEST CLARKE,

On the completion of my year of office as President of the Royal Agricultural Society for the fourth time, I am anxious to place on record my high sense of the valuable assistance and support given to me throughout the year by the Council and Officers of the Society, and to express to them and to the general body of Members my sincere thanks for the cordial goodwill and loyal attachment which all those connected with the Society have shown to me during my long association with it as a Member of the Council.

I remain,

Yours truly,

(Signed) ALBERT EDWARD P.

To Sir Ernest Clarke.

Though there were present at York all the conditions which have hitherto been regarded as essential to financial success, this much-desired result was not attained. An attendance of the public at least double of that which had been recorded when the gates finally closed might reasonably have been anticipated. The second York Meeting, held in 1883, was a conspicuous success in this respect, for with one exception it was the most profitable gathering the Society has ever held. A repetition of that success in 1900 would have constituted a welcome and an agreeable feature in connection with the last Show of the Century.

W. FREAM.

13 Hanover Square, W.

## THE TRIALS OF STEAM DIGGERS AT YORK.

Object of these trials was to determine primarily the quantity and quality of the work which could be performed by a steam Digger on heavy and light ground respectively, having regard at the same time to the mechanical fitness of the apparatus and the cost of working.

The trials were made on land at Kexby, about six miles from York during the week preceding the Show. The Judges were Mr. Walter Butler, 2 Whitehall Court, London, S.W., Mr. C. J. Foster-Kaye, Estate Office, Osberton, Worksop, and myself. The points to which the special attention of the Judges was directed may be summarised as follows:—

Quantity and quality of work done in a given time.

Cost of working.

Mechanical fitness of the apparatus.

General adaptability of engine to other purposes.

Weight.

Price.

There were two entries for the Prizes of 40*l.* & 20*l.*, offered by the Society:—

The Darby Land Digger Syndicate, Limited, 6 Billiter Street, London, E.C.

The Cooper Steam Digger Company, Limited, Steel Works, King's Lynn.

### GENERAL DESCRIPTION.

Fig. 1 gives a general view of the COOPER DIGGER. The digging is done by forks, which are placed in two rows, set apart, across the direction in which the machine travels, behind it. Each row is made up of four groups of equal prongs, each group forming a separate fork. In the one exhibited there were five prongs in each separate group in the front row, and a similar distribution in the back row, making forty prongs in all. The prongs of the front row are chisel-shaped, and sharp, and enter readily into new ground. The prongs in the second row are curved. These are

designed to break up the soil turned up by the prongs of the first row. The shapes of the prongs and their number are arranged to suit the different classes of work required.

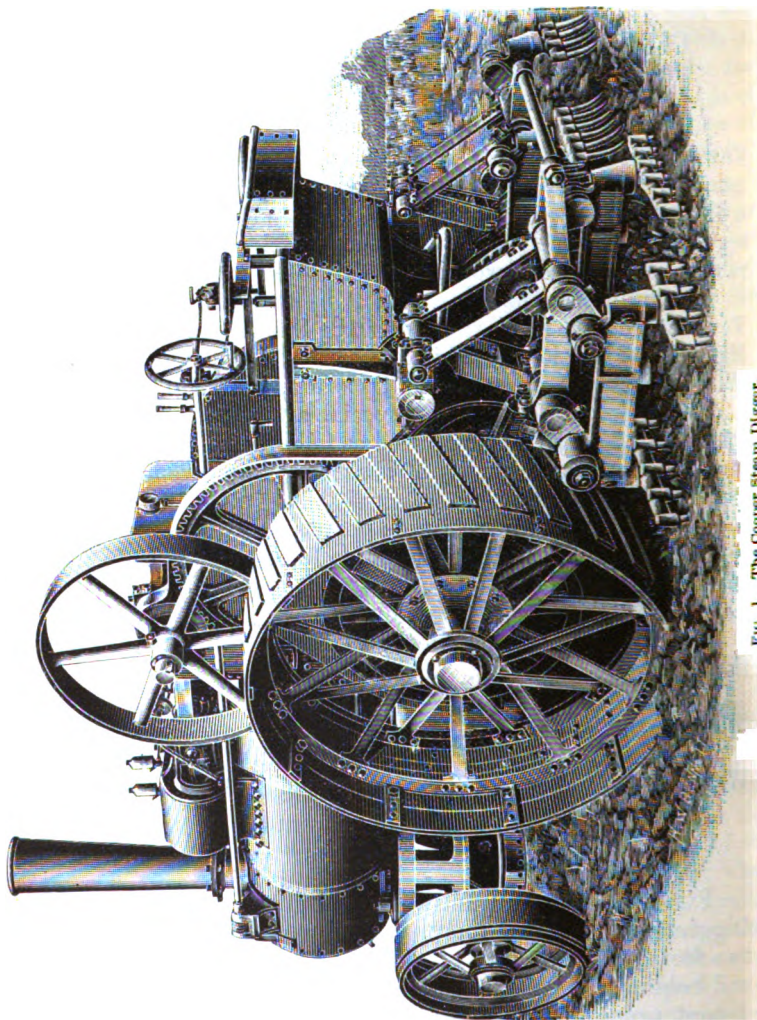


FIG. 1. The Conifer Steam Digger.

The forks have continuous circular motion in a vertical plane. The point of each prong therefore describes a trochoid when the digger is at work. The depth to which the prongs enter the ground can be regulated from three inches to eight

inches. The driving and controlling mechanism is shown diagrammatically in fig. 2. One side only is sketched in, the other side being precisely similar. A frame-work, shown black, is made up of two triangular-shaped end-pieces (one only shown) held rigidly together by a strong bar (not shown). This frame hangs by the apexes of the end-pieces  $c$  from the arms of a cross shaft  $w_1, w_2$  held in bearings on the engine-frame. This

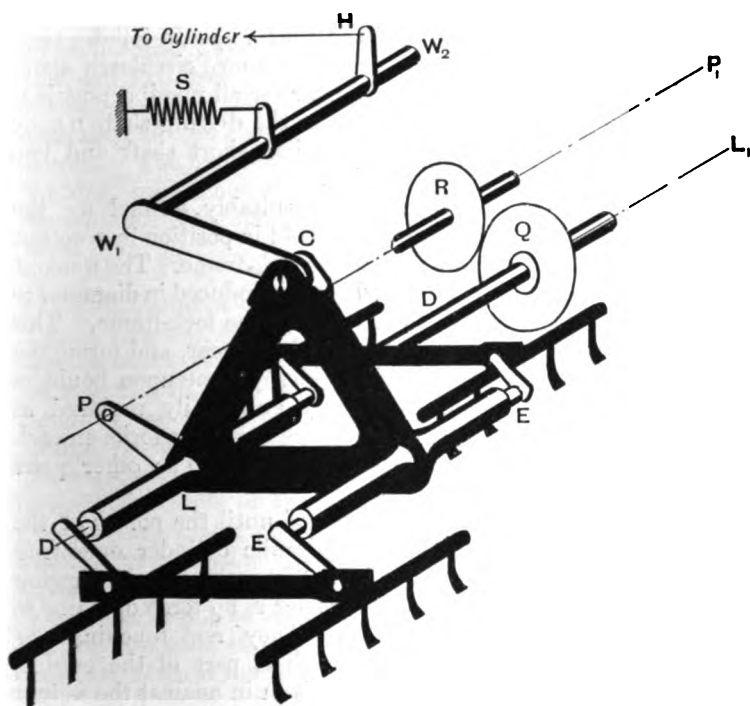


FIG. 2.—Diagram illustrating the driving and controlling mechanism in the Cooper Digger.

cross shaft is similar in form and function to the weigh-bar shaft of an ordinary locomotive link motion. By turning it, the frame is lifted or lowered, and, by means of a spring  $s$  acting on the shaft, the weight of the frame and the gear it carries is balanced.

The shaft is turned by means of a hydraulic cylinder connected to a suitably placed arm, as shown at  $H$  in the diagram. The cylinder is securely bolted to the engine-frame, and operated by the feed-pump. For travelling along the road the gear is pulled up by the pump, and then attached permanently to the engine-frame by short links.

The motion of the frame is further controlled by links (L P left-hand one), one on each side, connecting it to fixed pins at P on the engine-frame. The motion of the digger-frame is thus definitely constrained with respect to the engine frame, the axis L L<sub>1</sub> moving circularly about the axis P P<sub>1</sub> of the pins. The frame carries a crank-shaft D D, half of which only is shown. In the centre of this shaft is a spur-wheel Q, which receives motion from the engine by means of the wheel R, whose axis coincides with the axis of the pins P P<sub>1</sub>. It follows that, inasmuch as the axis L L<sub>1</sub> must always move circularly about P P<sub>1</sub>, the wheels remain properly in gear for all possible positions of the frame. A shaft E E is coupled to the driving-shaft D D, by short coupling rods. There is a similar short shaft and two coupling-rods on the right-hand side.

The ends of the coupling-rods are suitably formed for the attachment of the forks. The forks are held in position by a cotter, and each prong is also cotted into the fork-frame. The weakest part of the prong is at the neck, where it is reduced in diameter to form a shoulder against which it rests in the fork-frame. This is, indeed, the weakest part of the whole gear, and forms the breaking-point if the forks should suddenly come upon boulders or large stones. A prong is quickly and easily replaced at a small cost. The cranks are so arranged that the forks on each coupling-rod only enter the ground together. The other pairs follow in regular sequence.

To start digging, the gear is lowered until the points of the prongs rest on the ground. The hydraulic cylinder operating on H is then put entirely out of action. The weight of the digging gear being nearly balanced by the spring S, no force operates to drive the forks into the ground. They rest touching the surface until the driving-wheel R, which is part of the engine, drives the wheel Q. They are then driven in against the weight of the engine, and as a consequence the pressure between the hind wheels and the ground is decreased. How much it is decreased it is impossible to say. It depends upon the hardness of the ground and the depth of digging. The more vigorously the machine is digging, the less is the actual pressure on the land at the engine-wheels.

The depth to which the forks are driven is regulated by shoes, one on each side of the digging-frame. These shoes rest on the surface of the ground, and travelling over it follow its irregularities, maintaining the depth of digging constant, providing the irregularities are not too great. The position of the shoes is just in front of the leading row of forks. To adjust them the engine must be stopped.

the weight of the engine and digger in working order is 18 cwt. 2 qrs. Of this, 3 tons 3 cwt. 2 qrs. are on the front wheels, the rest, 8 tons 15 cwt., on the hind wheels. These are the pressures on the ground when the engine is standing, or travelling without digging. Immediately digging commences, these pressures are modified in the way already mentioned.

The weight of the detachable digging mechanism is 1 ton 10 cwt. 2 qrs. The wheels of the engine are wide, to distribute the weight well over the ground. The front wheels are 3 ft. 6 in. in diameter and 12 in. wide, and are brought close together so that they run on the strip of the track running between the hind wheels. The hind wheels are 5 ft. 9 in. diameter and 26 in. wide. The width of the track is 20 in. for road digging. This width may be reduced to 20 in. for road digging. This arrangement of wheels distributes the weight

The DARBY DIGGER, a general view of which is shown in fig. 4, consists essentially of a triangular-shaped frame, cross-sectioned about the centre, forming a letter A in plan. A roller wheel, 3 ft. 1 in. diameter, placed in the triangular compartment of the A and sliding in horns, carries the frame. This is dragged by the traction-engine, apex behind, the forward end being held up by chains attached to the axles of the hind wheels of the traction-engine. The sides of the A-frame carry shafts, on which pairs of bevel wheels give rotatory motion to vertical shafts at intervals of 1 ft. 2 in., there being such shafts protruding below the A-frame on each side. Considering one of these vertical shafts, it ends in a crosshead, the two ends of which are attached the digging tools. One of these vertical shafts and its crosshead are shown in fig. 4, with two digging-tools attached. A tool consists of a hexagonal spindle fixed to a spindle, which spindle fits loosely in the cross-

When the digger is at work the tools have a motion compounded of the forward motion of the whole apparatus, rotation about the axes of the crosshead, and an unknown and irregular motion round their own axes. The consequence is that each tool thoroughly undercuts a strip about 18 in. wide. The cutting tools are distributed in plan by means of the A-frame, so that the strips overlap, the total width of the strip worked being the ten pairs of cutters being about 12 ft.

The shafts along the sides of the A-frame are driven by a shaft near the open end, itself being driven through bevel wheels by an inclined shaft from the engine.

The A-frame, fig. 5, is carried by two chains, the nearer one *c* being shown in the diagram, passing over the roller frame. One end of each chain is fixed to the frame, the other is attached to

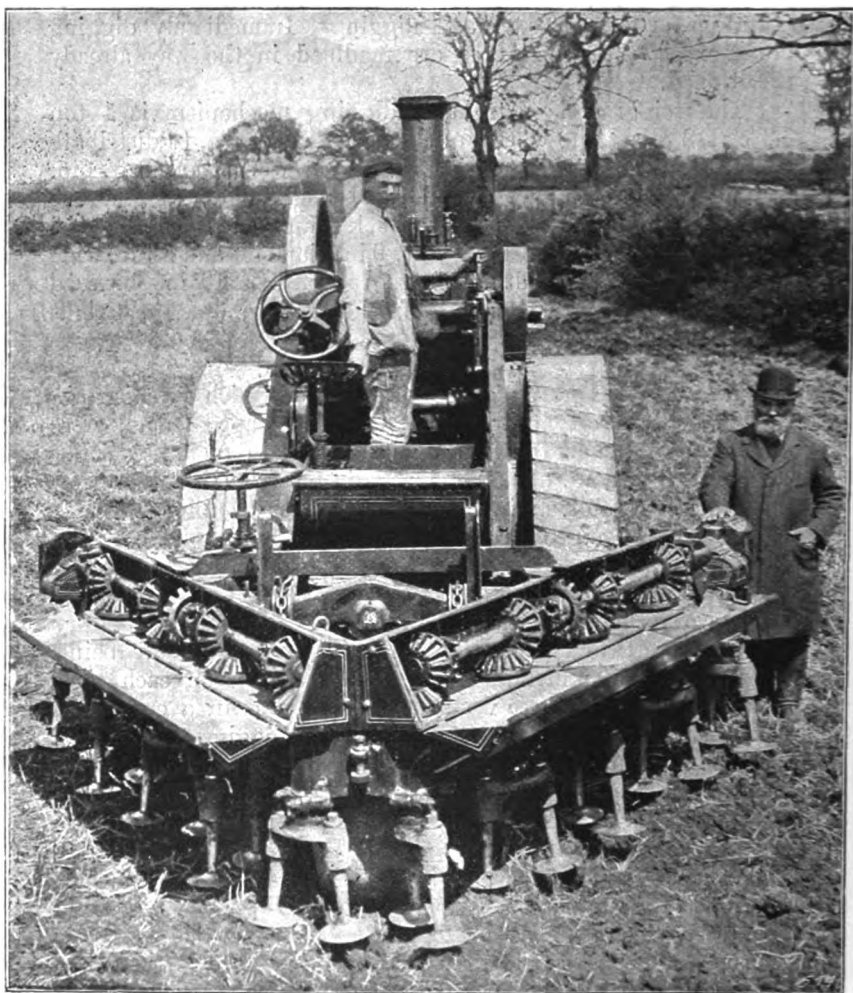


FIG. 3.—The Darby Steam Digger.

the cross shaft *s*. The roller *R* is not in the middle of the A-frame, it is nearest the apex. Consequently the open arms of the frame next the engine tend to drop. They are prevented from doing so by two chains, *k* being the right-hand one, each

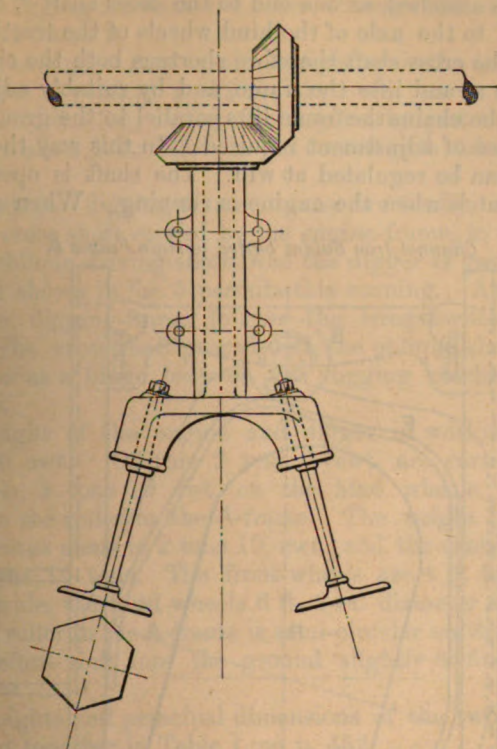


FIG. 4.—Digging-tools of Darby Digger.

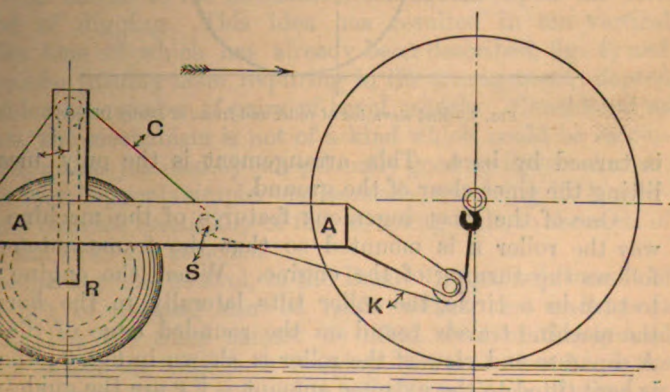


FIG. 5.—Side elevation of roller and frame of Darby Digger.

of which is attached, at one end to the cross shaft *s*, and at the other end to the axle of the hind wheels of the traction-engine. Turning the cross shaft therefore shortens both the chains *c* and the chains *k*, and lifts the frame, and by suitably adjusting the length of the chains the frame lifts parallel to the ground through the distance of adjustment required. In this way the depth of digging can be regulated at will. The shaft is operated by a friction clutch when the engine is running. When standing it

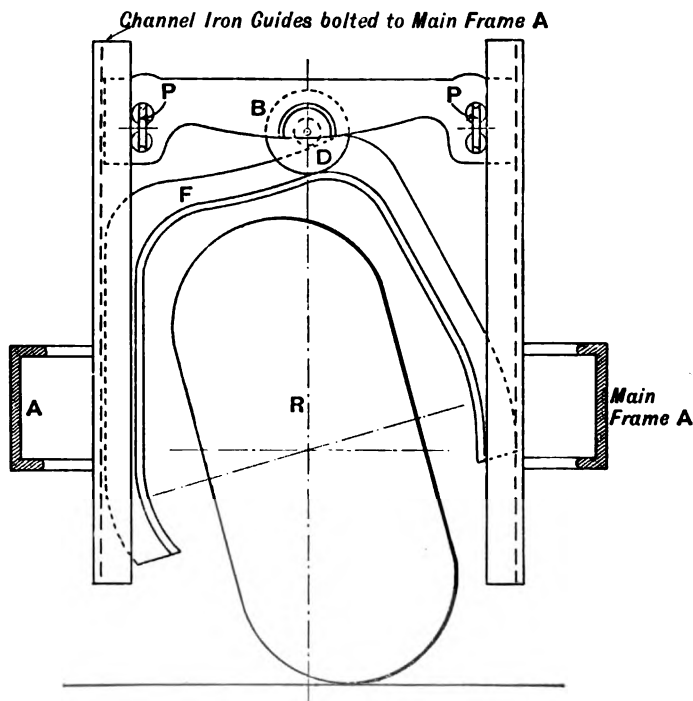


FIG. 6.—End elevation of roller and frame of Darby Digger.

is turned by bars. This arrangement is the only means for lifting the tines clear of the ground.

One of the most ingenious features of the machine is the way the roller *R* is mounted so that the frame automatically follows the turning of the engine. When the engine begins to turn in a circle, the roller tilts laterally in the horns, and the machine travels round on the rounded edge of the roller. A separate end view of the roller is shown in fig. 6; the roller is here tilted to the extreme amount. *P P* are the guide-pulleys for carrying the chains *c*, transmitting the weight of the trailing

the digging-frame to the roller, through the cross-bar B, D, and frame F.

When the engine runs on the straight again the roller and its assume a vertical position. At every curve it tilts to right or to the left, as the case may be, by just the amount necessary to allow it to follow in the curved path taken by the

The whole digging-frame turns vertically about the central cross shaft carried by the engine-frame, to which the oblique driving-shaft from the digger is geared. The arrangement shown in fig. 5 permits this turning. As a consequence the digging-frame follows the irregularities of the ground. The cross shaft geared with the oblique shaft may be taken upon as a hinge between the digging mechanism and the engine.

The weight of the engine and digger in working order is about 10 cwt. Of this 2 tons 5 cwt. are carried on the front wheels, 8 tons 10 cwt. on the hind wheels, and 1 ton on the roller in the A-frame. The weight of the digging-apparatus alone is 2 tons 10 cwt., and the traction-engine weighs 10 tons. The front wheels are 4 ft. in diameter and 16 in. wide, the hind wheels 6 ft. 3 in. diameter and 16 in. wide. The roller in the A-frame is semi-circular on the edge, and therefore sink into the ground slightly to find a proper bearing.

The weights and principal dimensions of the two machines are brought together in Table I. on p. 452.

The main idea operating in the design of the Darby Digger is the maintenance of a continuous and steady cutting action, to avoid the shocks to the mechanism consequent upon the fork lifting and of digging. This idea has resulted in ten vertical shafts (one of which has already been described, fig. 4) and a gear for turning them, requiring in the arrangement adopted a considerable number of pairs of bevel wheels. Considered as a whole, the mechanism is not of a kind which could be recommended, unless justified by exceptionally good agricultural work. The Darby Digger is simpler mechanically, requiring little gear-work and consists essentially of four coupling-rods, to the ends of which the forks are attached.

In comparing the control, in the Darby Digger adjustment of depth of digging can be made whilst the machine is working, but the tines cannot be lifted clear of the ground unless the engine is running; on the other hand the Darby Digger must be stopped to adjust the depth of digging, whereas the forks can be raised in a few seconds independently of

the engine. This method of control showed to advantage in the trials, in time saved at the headlands. Adjustment for depth of digging is not required frequently, whilst the power to lift the tines or forks clear independently of the engine facilitates handling at every turn. Both diggers can be easily detached from their respective engines, leaving the engines available for other work.

As will be seen from Table I., the Cooper Digger is lighter

TABLE I.—*Weights and Principal Dimensions, from Data supplied by the Exhibitors.*

	COOPER			DARBY		
	tons	cwt.	qrs.	tons	cwt.	qrs.
Weight on front wheels . . .	3	3	2	2	5	0
Weight on hind wheels . . .	8	15	0	{ 8 10 0 1 15 0		
TOTAL . . .	11	18	2	12	10	0
Weight of digger (separated from engine) . . .	1	17	2	2	10	0
{ Diameter of front wheels . . .	3' 6"			4' 0"		
{ Width . . .	12"			9"		
{ Diameter of hind wheels . . .	5' 9"			6' 3"		
{ Width . . .	26" digging, 20" travelling			16"		
{ Diameter of roller supporting digging mechanism . . .	—			3' 1"		
{ Width . . .	—			17" at widest part		
Greatest width over all for road travelling . . .	9' 4"			8' 10"		
Greatest width worked when digging . . .	9' 6"			12' 0"		
Stated maximum depth . . .	8"			10"		
Type of engine . . .	Compound			Simple		
Size of cylinders . . .	{ H.P. 6½" dia. 12" stroke L.P. 11½" " 12" "			9" dia. 12" stroke		
Steam pressure . . .	150 lb. per sq. in.			140 lb. per sq. in.		
Speed of travelling on the road . . .	{ 2 miles per hour 3.56 " "			2 miles per hour 4 " "		
Cost complete with traction engine . . .	£750			£845		
Cost of digger alone . . .	Not quoted separately			£350		

<sup>1</sup> Weight on roller of digger.

on the ground than its competitor. The weight is more uniformly distributed to start with, and the act of digging modifies the pressure on the wheels advantageously.

The relative cost of working and the quality of the work done may be inferred from the experiments detailed in the next section.

DETAILS OF THE TRIALS.

The "heavy ground" trials took place in a field belonging to Mr. Wenlock. The soil consisted of strong clay loam which had not been in cultivation for many years. Probably it had lain self down to grass in the first instance, and has been covered with rabbits from an adjacent wood ever since. The ground was in ridge and furrow, with sufficient sod on it to make it tough. It was also very hard, owing to a previous period of dry weather.

The "light ground" trials were made in a field belonging to House Farm, tenanted by Mr. Daniels. The soil was a light loam, in young seed after a corn crop. The surface was perfectly level, and therefore admirably suited for steam cultivation.

Although the ground was much lighter than that of the first field, it was hardened considerably by the dry weather.

*First Set of Trials.*

The diggers were first taken to the heavy ground, and set to work on their best on two adjoining plots, each  $1\frac{1}{4}$  acres. The direction of working was across the ridges and furrows. The trials were five times occupied and the water consumptions were noted.

The ground being so hard, this trial gave an excellent comparison of the relative capabilities and economy of the diggers, the evenness of the surface testing the relative facility of digging, the ease of adjustment, and their facility in setting out the work. The plots were carefully measured, and staked out with poles and flags.

A road ran through the plot on which the Darby machine was working, which was harder than the general surface of the heavy ground; on the other hand, the surface of the Cooper plot to the extreme right was more irregular than the surface of the heavy ground plot. The depths of digging were practically equal. As a whole, therefore, the work to be done by each may be taken as the same. The results of this trial are given in Table I. on p. 454.

A comparison between the numbers of square yards worked by each machine, given in column D, may be taken as a measure of the relative rates of working, and of the facility of handling. This experiment shows that the Cooper machine turned over about one acre whilst the Darby machine was doing three-quarters of an acre.

acre. As will be seen from the next set of experiments (col. G, Table III.), the relative rates of working, neglecting the time taken to turn at the headlands, is more nearly equal. The Darby machine is not so easily turned as its competitor, and hence lost more time at the headlands. The Cooper machine can be brought round and set to work again smartly. It should not be forgotten that this particular ratio of 1 to  $\frac{4}{3}$  is only true when the distance between the headlands is about 300 feet. For a greater distance the Darby Digger would in this respect compare more favourably, for a smaller distance less favourably, with the Cooper Digger.

To further test their relative facility of handling, each machine was set to turn on the level, in the smallest circle it

TABLE II.—*First Set of Trials on Heavy Ground, made on June 14, 1900.*

A	B	C	D	E	F	G	H
	Size of Plot	Time occupied in mins.	Square yards per min.	Ratio of rate of working	Gallons of water used. Total	Gallons of water used per acre	Ratio of cost per acre
COOPER {	181 ft. × 302 ft. 6,074 sq. yards 1·25 acres	150	40·5	1	310	168	1
DARBY {	181 ft. × 300 ft. 6,033 sq. yards 1·25 acres	189	31·4	·77	390	312	1·83

could. The Cooper machine was turned in a circle, the outer radius of which was 24 ft. 6 in. when going forwards, and 28 ft. 6 in. when running backwards. The Darby machine was turned more slowly in circles, the outer diameters of which were 82 ft. forwards and 52 ft. backwards. This experiment indicates the greater facility of handling at the headlands inherent in the Cooper design.

*The Cost of Working.*—This may be measured by the water consumption, assuming that each boiler evaporates the same amount of water per pound of coal, a not unreasonable assumption to make, since both boilers were of the same general type. The water supplied was dirty, and foamed in the feed-tanks, consequently the consumption does not fairly measure the absolute performance of the engines ; but it furnishes sufficiently

accurate data for estimating the relative economy of the two machines, since each was supplied with the same kind of water.

The consumption is expressed in gallons per acre in column G, and the ratio 1 to say  $1\frac{1}{4}$  expresses approximately the cost of working an acre of the ground selected by the Cooper and Darby machines respectively, so far as fuel is concerned. The greater economy of the Cooper Digger is no doubt partly due to the fact that a compound engine is used to drive the digging gear; the Darby Digger is driven by a simple engine.

*Quality of the Work.*—The Cooper Digger made very good work, the second row of prongs effectually breaking up the sod, when the machine was able to travel at its ordinary pace. In getting out of some of the deeper furrows the speed was slower, and the prongs were not at their proper digging depth, and the character of the work just there was not so good. In general the ground was left in a suitable state for subsequent horse-cultivation.

The Darby Digger cut well under the sod, but did not sufficiently break it up or turn it over. Consequently the ground was left in a state unsuitable for succeeding horse-cultivation. The surface of the undercut sods had not suffered much when examined two days after the work had been done.

### *Second Set of Trials.*

The light ground, already described, on which this set of trials was made was practically level. Each machine was subjected to the following set of experiments:—

(1) The engine was driven at its digging speed. The digging apparatus was in gear, but held up clear of the ground, so that it was running idle. Two sets of indicator cards were taken under these conditions.

(2) The driver was told to dig lightly, about  $4\frac{1}{2}$  inches, and to do his best at this depth. Two sets of indicator cards were taken under these conditions.

(3) The driver was told to dig heavily, and to do the greatest amount of work possible. No particular depth was specified. This was left entirely to the driver's discretion. Two sets of indicator cards were taken under these conditions.

In each of these three cases, the diggers were run long enough to take the necessary diagrams only. No turning was required. In considering the results of this set of experiments therefore the effect on the various quantities of the time which would be lost, turning at the headlands, is not considered. The conditions of the trials are about the same as when a plot is

TABLE III.—Summary of Second Set of Trials made on Light Ground, June 15, 1900.

A	B	C	D	E	F	G	H	I	J	K
Conditions of the trial	Name	Average I.H.P.	Average revolutions per min. of engine crank-shaft	Average speed of travel-ling in yards per min.	Width worked in yards	Number of sq. yards turned up per min.	Weight of soil turned up in pounds per sq. yard	Weight of soil turned up in pounds per min.	Weight of soil turned up in pounds per I.H.P. per min.	Square yards worked per I.H.P. per hour
Diggers running idle	COOPER	12.27	228	26.1	3.18	—	—	—	—	—
	DARBY	10.80	194	16.1	4.00	—	—	—	—	—
Digging lightly	COOPER	32.04	217	24.7	3.18	78.5	383	30,065	938	147
	DARBY	33.40	193	16.0	4.00	64.0	372	23,808	713	115
Digging heavily	COOPER	40.09	202	23.0	3.18	73.2	428	31,329	782	109
	DARBY	46.60	204	16.9	4.00	67.6	413	27,920	600	87

worked circumferentially instead of backwards and forwards. The experiments are strictly comparative, since the two diggers worked respectively on parallel strips of ground close together.

The results of the tests are set forth in Table III.

*Columns C and D.*—The indicated horse-power has been computed in every case from each separate diagram. The results are tabulated in Tables I. and II. of the Appendix (p. 460). The average horse-power and the average revolutions of the engine crank-shaft for each set of experiments are given again in columns C and D respectively of Table III., and these figures have been used in working out the final results. This method was adopted because the diagrams were not taken simultaneously, and consequently the speed was different in many cases for diagrams taken from the two ends of the same cylinder, and apparently a pair. In the Cooper engine, the sum of the horse-powers given in Table I. of the Appendix corresponding to the eight diagrams per experiment, divided by four, gives the average I.H.P. For the Darby engine four diagrams form a set, and the sum of the horse-powers computed for each divided by four gives the average I.H.P. The excellent distribution of work in the Cooper compound engine should be noticed. In Appendix Table I., p. 460, results 9 and 10 should be taken together, and again results 11 and 12.

*Column E.*—The average speed of travelling was computed from the revolutions given in column D and the gearing of the machine.

In the Cooper Digger the road wheel, which is 6 yards in circumference, made one revolution for 52·6 revolutions of the crank-shaft. Consequently the engine travels ·114 yards for one revolution of the crank-shaft, and the speed of travelling in yards per minute is given by ·114 N, where N is the number of revolutions of the crank-shaft per minute.

In the Darby Digger the corresponding formula is ·083 N, one revolution of the crank-shaft corresponding to three inches travel.

*Column F.*—The width worked was ascertained by measuring the combined width of two adjacent tracks, the driver being told to join the tracks on to one another in the same way that he would do in ordinary work. In each case the average came out so nearly equal to the distance between the two outermost forks or tines that this distance has been taken, viz. 9 ft. 6 in. for the Cooper machine, and 12 ft. for the Darby machine.

*Column G.*—The numbers in this column are obtained by multiplying the corresponding numbers on the same level in

columns E and F. The actual depths of digging by the two machines were much about the same in the respective experiments, so that the numbers in this column give a comparative measure of the time required to do equal areas, neglecting turning at the headlands.

*Column H.*—To measure the weight of soil turned up per square yard, an angle iron frame enclosing exactly one square yard was placed on the worked ground: the loosened soil was gathered up by hand and put into iron drums, which were immediately carried to a platform weighing-machine close to the work, and the soil weighed. A comparison of the figures in column H shows that both the diggers were working at about equal depths in the two experiments.

*Column I.*—The numbers in this column are obtained by multiplying the corresponding numbers in columns G and H, together. They represent what the machines can do in a given time, that is to say, they are proportional to the respective rates of working, under the different conditions stated. Taken alone they represent the relative mechanical capabilities of the two machines, that is, what they can do without reference to the quality of the work, considered from an agricultural point of view.

*Column J.*—One way of looking at the results is to consider the cost of working with reference to the weight of soil turned up per I.H.P. per minute. The numbers expressing this in column J are found by dividing the corresponding numbers of column I by those on the same level in column C.

*Column K.*—Another way is to state the number of square yards worked per I.H.P. per hour at a fixed depth. The numbers giving this are found by dividing the corresponding numbers of column G by those on the same level in column C, and multiplying by 60.

A point brought out by the experiments, and shown in Table III., is, that when digging heavily in the third experiment, although the forks of the Cooper Digger were apparently digging 7 in. to 8 in. deep, and the tines of the Darby Digger were buried 7 in. to 8 in., and although the horse-power was in each case much greater, yet the weight of soil turned up per square yard was not increased in proportion either to the apparent depth of digging or to the horse-power. As a consequence, as shown in column J, the diggers were both more efficient on the smaller depth of the second experiment.

*The Cost of Working.*—The cost of the energy represented by

I.P. hour, i.e. 1,980,000 foot-lb., depends upon the cost of accessibility of water, cost of labour, and the kind of engine employed. So far as the economy of the engine is concerned, no allowance may be made to the trials carried out by the Society at Newcastle.<sup>1</sup> The meaning of the figures given in column K is that for the definite expenditure of the above quantity of work, at the cost what it may, the number of square yards given can be turned up working under the conditions stated. Similarly the weight of soil given in column J can be turned over for the definite expenditure of 33,000 foot-lb. of work.

*Quality of the Work.*—The same characteristics showed themselves in the work of the diggers in the light ground as in the heavy ground. The Cooper Digger worked the ground well and evenly. The surface was broken and thrown up and left in a state suitable for horse-cultivation to follow. The Darby Digger, though cutting under well, did not move the surface evenly. When inspected two days after the trial, the work of the Cooper Digger was close to it.

In conclusion, the Judges would like to make acknowledgment of the courtesy and valuable assistance given to them by Mr. Courtney, Consulting Engineer to the Society.

W. E. DALBY.

London Institute Technical  
College, Finsbury, E.C.

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<sup>1</sup> Journal R.A.S.E., 2nd series, vol. xxiii, 1887, p. 681.

## APPENDIX.

TABLE I.—COOPER DIGGER.

*Type of Engine.*—Two-cylinder compound.*Cylinders.*—High pressure,  $6\frac{1}{2}$ -in. diam., 12-in. stroke; Low pressure,  $11\frac{1}{2}$ -in. diam., 12-in. stroke. Both piston rods,  $1\frac{1}{4}$ -in. diam.*Boiler Pressure.*—150 lb. per sq. in.

Conditions of experiment	Number of card	End of Cylinder	Mean Pressure, lb. per sq. inch	Revolutions per minute	I.H.P.	Average I.H.P.	Average Revolutions per min.
Diggers running idle	1	H.P. front	20.0	256	9.90	12.27	228
		H.P. back	19.45	"	10.00		
	2	L.P. front	2.76	"	4.36		
		L.P. back	3.12	"	4.87		
	3	H.P. front	19.2	200	7.43		
		H.P. back	19.85	"	8.00		
	4	L.P. front	2.2	"	2.72		
		L.P. back	1.48	"	1.80		
Digging "lightly"	5	H.P. front	40.0	217	16.75	32.04	217
		H.P. back	39.8	"	17.40		
	6	L.P. front	11.9	"	15.95		
		L.P. back	10.8	"	14.30		
	7	H.P. front	38.5	"	16.10		
		H.P. back	37.0	"	16.15		
	8	L.P. front	13.4	"	17.90		
		L.P. back	10.25	"	13.60		
Digging "heavily"	9	H.P. front	51.5	217	21.60	40.09	202
		H.P. back	48.6	"	21.20		
	10	L.P. front	16.4	"	22.00		
		L.P. back	16.3	"	21.60		
	11	H.P. front	48.5	188	17.60		
		H.P. back	51.2	"	19.35		
		L.P. front	16.5	"	19.20		
	12	L.P. back	15.5	"	17.80		

TABLE II.—DARBY DIGGER.

*Type of Engine.*—Single-cylinder simple.*Cylinder.*—9-in. diam., 12-in. stroke. Piston-rod,  $1\frac{1}{8}$ -in. diam.*Boiler Pressure.*—140 lb. per sq. in.

Conditions of experiment	No. of card	End of Cylinder	Mean Pressure lb per sq. in.	Revolutions per min.	I.H.P.	Average I.H.P.	Average Revolutions per min.
Diggers running idle	I.	Back	14.7	200	11.30	10.8	194
	II.	Front	12.8	184	8.74		
	III.	Back	17.43	200	13.40		
	IV.	Front	14.0	192	10.00		
Digging "lightly"	V.	Back	53.0	187	38.1	33.4	193
	VI.	Front	39.6	200	30.45		
	VII.	Back	49.9	198	38.0		
	VIII.	Front	38.8	187	27.0		
Digging "heavily"	IX.	Back	69.28	214	57.0	46.6	204
	X.	Front	60.0	187	41.8		
	XI.	Back	60.5	214	49.7		
	XII.	Front	50.4	200	37.5		

## THE TRIALS OF HORSE-POWER CULTIVATORS AT YORK.

Trials took place on some fields at Kexby, about six miles from York, the property of Lord Wenlock, on Tuesday, June 12, following days, the Judges being Mr. Walter Butler, 2 Whitecourt, London, S.W., Professor W. E. Dalby, Technical College, Finsbury, London, E.C., and Mr. C. W. Lister Kaye, Worksop, Nottingham. There were eighteen entries from different exhibitors, and sixteen were tried on June 12. The cultivators were practically divided into two classes, Spring tines and Spring tines, although, strictly speaking, as only one really rigid tine—viz. Coleman & Morton, was in other cases being given in some way or other by

a field in which the first trials took place was strong clay that had not been under cultivation for very many years, eminently suited for thoroughly testing the powers of cultivators as implements for “breaking up” land, as, owing to dry weather, it was exceedingly hard. This field was in and not let.

At the end of the trials on the first day it was decided by the Judges that five machines had so satisfactorily stood the test of this strong land that they should be further tested on the following day in a field occupied by Lord Wenlock's Mr. Daniell. This was a sandy loam, very level, in pasture, and again, owing to the drought, extremely hard surface.

The machines that were to be submitted to this further and exhaustive trial were:—

Annex. Names and Addresses of Exhibitors.

Harrison Patents Co., Ltd., Stamford, No. 5, price 8*l.* 10*s.*

Coleman & Morton, Chelmsford, No. 8, price 11*l.* 10*s.*

W. N. Nicholson & Sons, Ltd., Newark-on-Trent, No. S.O., price 8*l.* 10*s.*

J. L. Larkworthy & Co., Worcester, No. V.C. 2, price 14*l.*

T. A. Meggeson, Stockton-on-Tees, ten tines with front swivel wheel, price 11*l.*

The machines on the second day were tested by having a land measured out, which had to be cross cultivated by practically as such work would be carried out on a farm.

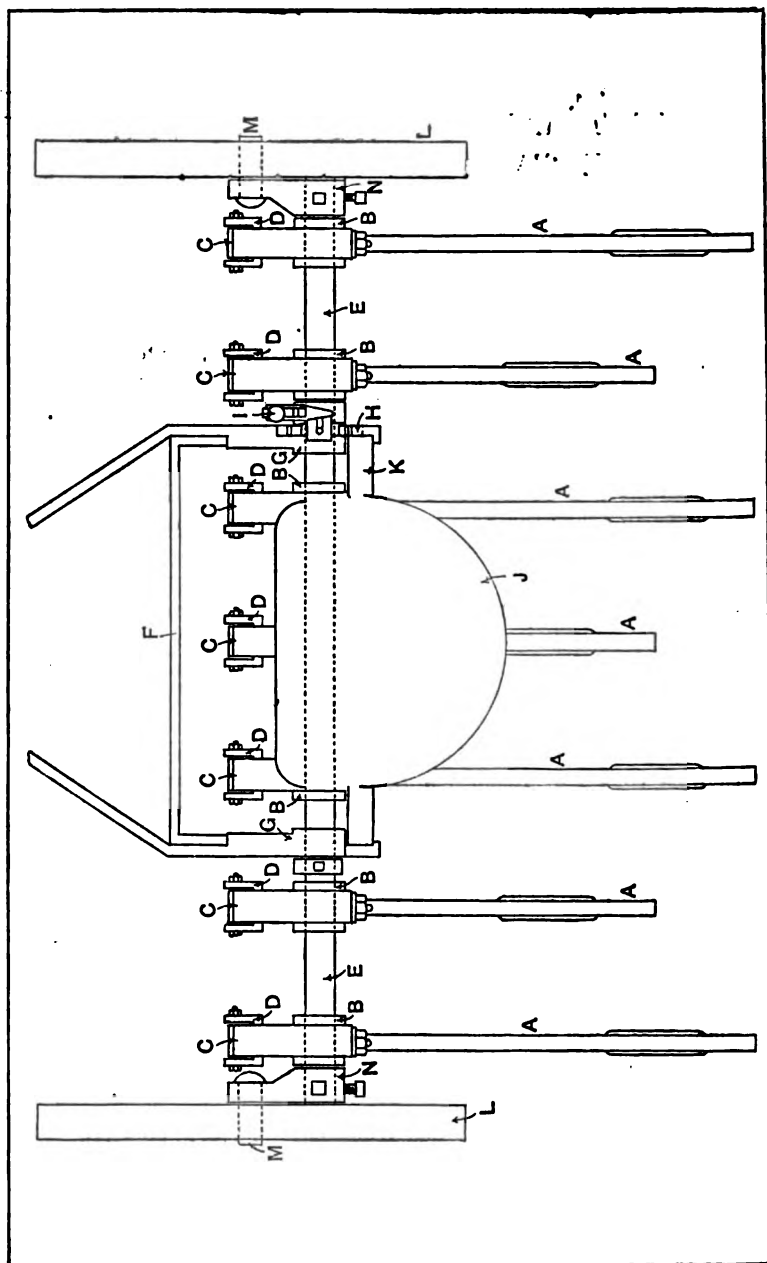


FIG. 1.—Harrison Patents Co.'s Cultivator, end view.

After this had been done, a certain number of the machines were tested on the Society's Dynamometer, drawn by a traction engine, and in estimating the final results two square yards of soil were selected from the track of each cultivator and carefully weighed.

The first prize of 40*l.* was awarded to No. 3237, Harrison Patents Co., Ltd., No. 5; and the second prize of 20*l.* to No. 3322, Coleman & Morton, No. 8. In reference to these two machines I proceed to give a few further details.

No. 3237, *Harrison Patents Co., Ltd.*, made undoubtedly the best work, laying the land well up and open, and was easily adjusted from nothing to seven inches. A certain amount of elasticity was given to the tines from the strong spring which allowed them to vibrate, but not to pull too far back or rise out of the ground. This latter difficulty has been overcome by Mr. Martin's invention, which consists of tines made of rectangular or of other suitable section metal, bent to an improved sickle shape, and having either forged or renewable shares. The front ends of these tines pass through and are free to move in slots in guide blocks secured to the frame of the machine, and terminate in forks or other suitable device, by which they are jointly secured to U-shaped springs, the other end of these springs being rigidly fixed to guide blocks on the frame, so that when the machine is at work the springs will keep the tines in a continual state of vibration, and if they should encounter a very hard piece of ground or obstruction, the springs can only be compressed to the guide blocks, in which case the tines would then be practically solid and so keep to the work.

In order to describe the cultivator further I give two drawings in which like letters represent like parts, fig. 1 representing an end view of the cultivator, and fig. 2 a side view of one of the tines. A are the tines (shown with reversible steel shares) which pass through the guide blocks B, and are free to move therein, and terminate in forks D. The springs C are secured to guide blocks B, by means of nuts, washers, and screwed studs; the other ends of these springs are formed into loops or eyes, and are connected to the forks D, with a bolt or pin, so that they form joints. It will be seen that, by these means, when the tines are in work they will be kept in a continual state of vibration, and should they meet with a hard piece of ground or other obstruction, the springs C can only be compressed up to the forks D, touching the guide blocks B, when the machine will have practically non-yielding tines until the obstruction is passed; they will then spring back to their normal position.

The guide blocks B are secured in any required position on bar E, of round or other suitable section; this bar passes through and is free to rotate in journals G, which are connected to and form part of frame F. A lever I is also secured to the bar E, and by its spring and pawl engaging in quadrant H on frame, the tines can be set in the required position or lifted clear of the ground, for the better convenience of turning or clearing of rubbish.

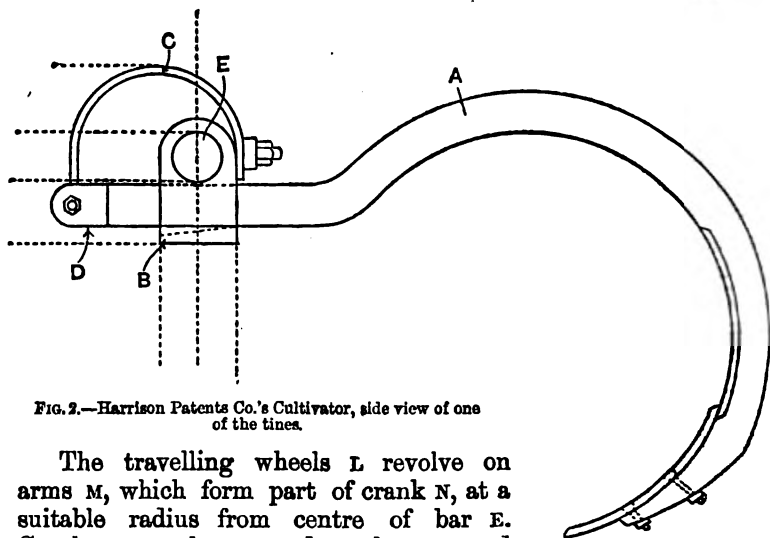


FIG. 2.—Harrison Patents Co.'s Cultivator, side view of one of the tines.

The travelling wheels L revolve on arms M, which form part of crank N, at a suitable radius from centre of bar E. Crank N can be rotated on bar E, and secured in any required position thereon by means of set screws or other suitable device, so that the arms M may be above or below the centre of bar E, and by this means regulate the tines A to an equal working depth. A seat J is connected to the frame F by means of a bow K, but this is not an essential feature, as the machine may be worked with or without a seat. The swivel wheel O might be at any time removed and a pole or shafts substituted. I have now described the first prize machine in detail, and may say that when the Judges went over the land two days after the trials their previous decisions were fully confirmed by the condition of the plots cultivated.

No. 3322, *Coleman & Morton*, No. 8, price 11l. 10s., the second prize machine, has been for many years before the public, and has always been recognised as a strong good working machine. This was the only machine exhibited with absolutely rigid tines. Its weight is about 6 cwt. 2 gra., and with four horses it made good work in the strong land; its steadiness was remarkable, and the angle the tines are

set at in my opinion tends to increase this steadiness and keep the tines well in work. Fig. 3 represents one of Messrs. Coleman & Morton's No. 6 machines, identical with No. 8, except that the latter has seven tines.

The following other machines showed a certain amount of capability to deal with the hard land :—

No. 3150, *T. A. Meggeson*, Stockton-on-Tees, ten tines with front swivel wheel, price 11*l.*, worked by four horses.

No. 3769, *W. N. Nicholson & Sons, Ltd.*, Newark-on-Trent, No. S.O., price 8*l.* 10*s.* This machine has locking action the same as their horse rakes.

No. 3377, *Larkworthy & Co.*, Worcester, No. V.C. 2, price 14*l.* This is an ingeniously contrived machine, and would

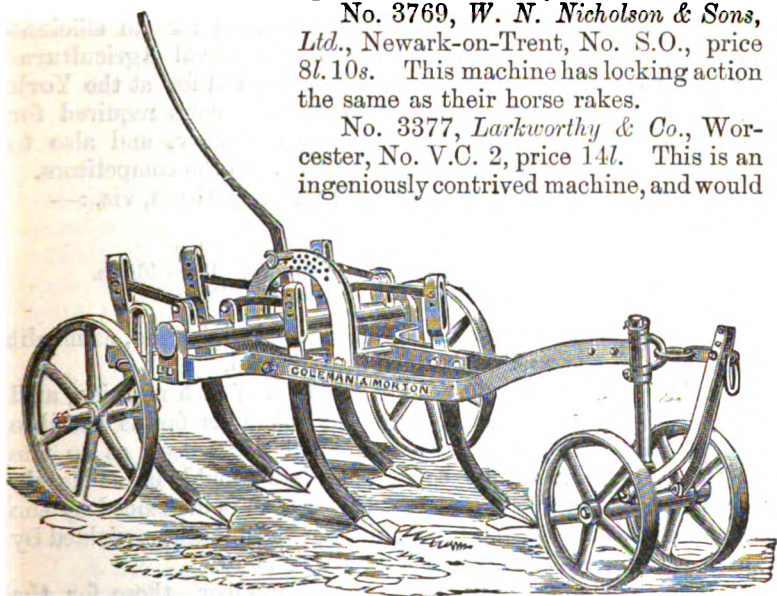


FIG. 3.—Coleman & Morton's Cultivator.

be a very useful implement for work after the plough. It can also be easily adjusted for acting as a scuffler or for earthing up potatoes, taking three rows in each case. The implement as used for cultivating can, by removing some of the tines and readjusting their positions, be employed for cleaning three rows of roots or potatoes, and by substituting breasts for the tines it may further be used for moulding up three rows at a time.

I cannot conclude this report without thanking Mr. Courtney, the Society's Engineer, the Stewards, and various officials for their valuable aid, unvarying kindness, and help to us during some of the hottest days of this summer when we were engaged at Kexby.

C. W. LISTER-KAYE.

- Estate Office, Osberton, Worksop.

## THE TRIALS OF MILKING MACHINES AT YORK.

THE increasing difficulty in most districts of obtaining milking hands, and the consequent growing demand for an efficient milking machine, led the Council of the Royal Agricultural Society to offer a prize of 50*l.* to be competed for at the York Meeting, the Society arranging to find the cows required for the trials and demonstrations during the show, and also to provide the necessary shedding free of cost to the competitors.

Only two machines were entered for competition, viz. :—

No. in Catalogue.	Names and Addresses of Exhibitors.
4786	William Murchland, Kilmarnock. Price 46 <i>l.</i> 4 <i>s.</i>
4787	Lawrence & Kennedy, Glasgow. Price 48 <i>l.</i>

The machines differed materially in principle, and, as might be expected, the results obtained also differed.

Six cows were provided for the trial of each machine, and in the selection of each lot care was taken as far as possible that, while there should be individual differences as to the milking qualities of the cows, both lots should be as nearly similar as practicable ; and that this was so is evidenced by the result of the Friday morning's milking, the quantities yielded by each lot being 132½*lb.* and 130*lb.* respectively.

Each cow was given a distinctive number, those for the Murchland machines being numbered 1, 2, 7, 11, 9, 10, and those for the Laurence & Kennedy 3, 6, 4, 5, 8 and 12.

The cows were delivered into the Show Ground on Thursday evening, June 14, and the trials commenced on Friday, June 15, on the morning of which day they were tested by the Judges to ascertain the efficiency and ease of working of each machine. At the afternoon milking, the exhibitors had the opportunity of working their machines independent of the Judges, and on Saturday morning a further test of efficiency and time taken to do the work was made by the Judges.

### DESCRIPTION OF THE MACHINES.

No. 4786. *William Murchland*.—This plant consists of a small oil engine, actuating a small pump, the suction of which

is connected to the upper side of a raised *closed* tank; from the bottom of this tank a pipe communicates with a tank of smaller capacity at the ground level, charged with water, the raised tank being some 16 or 18 ft. above the ground. On the suction-pipe, between the raised tank and the pump, are one or more branch pipes, which lead round or along the cow-stalls.

From this description it will be seen that if the pump is set to work, the first operation will be the exhausting of the suction-pipe with its branches and the enclosed tank, the water from the lower tank rising in the communicating-pipe until a vacuum, due to the height of the column of water between the water level in the two tanks, is obtained; this is regulated at about 16 ft., and ensures an effective vacuum equal to 15 inches of mercury. This arrangement provides a simple means for maintaining within certain limits a very uniform vacuum, for if the pump should be running rather too fast for the demands put upon it, it follows that as the lower tank is smaller than the upper one, the former would be emptied, and that the communicating-pipe between the two tanks would deliver just sufficient air to prevent the pump from increasing the vacuum in the upper closed tank. If, on the other hand, a momentary increased draught takes place on the pipes in communication with the pump, there would be a tendency to diminish the vacuum in the closed tank, which, at the time, is partially filled with water, and which at once commences to return to the lower tank, and thus maintains a uniform vacuum within the limits of the capacities of the tanks.

It will be seen from the above that the object to be obtained is a "uniform vacuum," with a certain provision that it shall not be exceeded, and this result was secured.

The milking apparatus consisted of a closed tinned pail which was slung underneath the cow by means of a strap passing over her back. An indiarubber tube connection was made between the pail and the vacuum pipes arranged along the stalls by which a vacuum of 15 inches was maintained in the pail.

Four separate tubes are provided from the cover of the pail to the teat holders. These consist of an external indiarubber holder, the upper portion of which—owing to the vacuum created therein—adheres to the upper portion of the teat. Inside this outer holder is an internal tin holder, in which the teat is placed, while the upper part of this holder is provided with several small holes, and it is claimed that the vacuum

communicated from the outer holder at this point relaxes the upper muscles of the teat and produces a freer flow of milk. A hole is provided in the bottom of the tin holder through which the milk is drawn from the teat, and passes direct to the receiving pail.

It will be noticed that in this arrangement the intermittent action of the suction of a calf is set aside, and replaced by a uniform continuous suction.

The tabular results show that the milking was done more rapidly by this method than by the machine which provided intermittent suction, and that, taking the records of the nine milkings, less strippings were left. As to what effect the prolonged use of this continuous suction might have on the natural powers of a cow to retain her milk, these trials could give no indication.

The arrangement of the teat-holders, tubing, and receiving pail presented such difficulties for efficient cleaning that the Judges were unable to report that it adequately fulfilled the requirements set forth in the regulations for these trials.

No. 4787. *Lawrence & Kennedy*.—A small vertical steam boiler—which might also be used for providing hot water or steam for scalding in the dairy—supplied steam for working a direct-acting steam ejector, which maintained the desired vacuum in the line of pipes laid round the several stalls for the cows.

The milking apparatus, which was connected with the above vacuum pipes, consisted of a closed collecting pail, on the lid of which was mounted a small horizontal direct-acting pump, worked by the vacuum in the receiving pail; this pump was connected to a glass receiving chamber, in which at each stroke of the pump the vacuum was partially destroyed, thus producing pulsations. From this receiving vessel two indiarubber pipes with cocks branch out, and on each of these four movable rubber tubes are fitted, attached at the other ends to the teat cups, one pail serving two cows. The cups are made in one piece of indiarubber of such consistency as to give just the desired amount of collapse and expansion with each stroke of the pulsating machine. The milking of two cows simultaneously is not desirable, as it is somewhat difficult to see which cow is being milked, and the milk from both going into one pail gives no opportunity of weighing each cow's milk. This, of course, might be got over by milking only one cow at a time, but the capital outlay on the milking-pails and apparatus would be

ed, the price for each, independent of the boiler and  
r, being 12l. The connection between the cup and the  
ubber tube is made by a wooden plug provided with a  
of metal tube. Although the indiarubber cup may be easy  
ean, this connection might be improved upon in that  
t.

he pulsating action as an imitation of the natural suction  
calf was fairly accomplished, but the time occupied in  
g, and the general working of the machine, did not satisfy  
dges that it was yet sufficiently developed to justify an

a Friday, June 15, the first trial of these machines was  
the Judges being Mr. Bayntun Hippiisley, Ston Easton  
Bath, and Mr. Francis E. Walker, Escrick, York. It  
rranged that each lot of six cows should be milked  
aneously, two in each lot having previously been partially  
l by hand. This was done to see if cows not over-stocked  
object to the application of either machine.

he total quantity of milk gained by the machines was  
ed, the cows were then stripped by hand and the strippings  
ed. Table I. sets out the results obtained :—

TABLE I. (Friday, June 15, 1900.)

Owner's name	William Murchland						Lawrence & Kennedy					
Serial number of cow	3	6	4	5	8	12	1	2	7	11	9	10
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Milk milked by hand	—	—	11	9½	—	—	—	—	—	8½	8¾	—
„ „ machine	—	—	9¾	8¼	—	—	—	—	—	—	10¼	—
Milking of each cow as	20½ 18½ 20¾ 17¾ 15¼ 13¼						29¾ 30½ 27½					
ed by machine	4¼ 3 2½ 6 5 5½						10½ 6½ 14½ 1½ 3¾ 5½					
ggs	106 lb.						87¾ lb.					
Milk by machine	26¼ lb.						42¼ lb.					
ripping												
age of milk gained by	80.1 per cent.						67.5 per cent.					
ne compared with												
milk												

he cows took remarkably quietly to the application of the  
es, but it is evident from the above figures that some  
d themselves to be milked more freely by the machines  
others. It was therefore arranged that at the next  
ach exhibitor might select, out of his lot, the three

easiest cows to milk. This trial was made on the following morning (Saturday, June 16), the result being given in Table II. :—

TABLE II. (*Saturday, June 16, A.M.*)

Exhibitor's name . . . . .	William Murchland			Lawrence & Kennedy		
Distinctive number of cow . . . .	3	4	5 <sup>1</sup>	1	11	9
Time taken to milk . . . . .	8 minutes			20½	minutes	
Net quantity milked by machine	lb. 21½	lb. 20½	lb. 14½	lb. 26½	lb. 21½	lb. 15½
Net strippings . . . . .	1½	4½	8¾	4½	2	2½
Total milked by machine . . . .	56.5 lb.			63.75 lb.		
Total strippings . . . . .	14.75 lb.			8.75 lb.		
Percentage of milk gained by machine compared with total milk . . . . .	79.29 per cent.			87.9 per cent.		

<sup>1</sup> This cow kicked the machine off and declined to continue the operation of milking with the machine.

For the remaining period that the cows were in the show-yard a record was kept of the strippings from each cow for each milking. Table III. gives the details for the *whole* time, including first trial :—

TABLE III.

Exhibitor's name	William Murchland						
Distinctive number of cow	3	6	4	5	8	12	Total for each milking
June 15 . . . . .	lb. 4½	lb. 3	lb. 2½	lb. 6	lb. 5	lb. 5½	lb. 26½
" 16 A.M. . . . .	1½	—	4½	—	8½	—	14½
" " P.M. . . . .	—	6	1	2½	—	2	13
" 17 A.M. . . . .	3	1½	3½	3½	2½	1½	15½
" " P.M. . . . .	1½	1	1½	2½	—	1½	8½
" 18 A.M. . . . .	0	1¾	2¾	4	1½	1½	11½
" " P.M. . . . .	¼	½	1	2½	—	1½	5½
" 19 A.M. . . . .	2¾	¼	1½	2	—	1	8½
" " P.M. . . . .	½	½	1	1½	—	1½	5½
Total strippings for each cow	14½	14½	19½	24	21½	15½	109
Mean strippings for each cow	1.6	1.8	2.39	3	2.38	1.9	—

TABLE III.—*continued.*

Exhibitor's name	Lawrence & Kennedy						
Distinctive number of cow	1	2	7	11	9	10	Total for each milking
June 15 . . . . .	lb.	lb.	lb.	lb.	lb.	lb.	lb.
strippings	10½	6½	14½	1½	3½	5½	42½
" 16 A.M. . . . .	4½	—	—	2	—	2½	8½
" " P.M. . . . .	3½	4½	2½	1½	2½	1½	15½
" 17 A.M. . . . .	4	17	1½	1½	1½	2	27½
" " P.M. . . . .	2½	6½	1½	1½	1½	2½	14½
" 18 A.M. . . . .	3½	10½	4½	3½	1½	1	21½
" " P.M. . . . .	2½	7	1	1	1	5½	18
" 19 A.M. . . . .	5½	14½	6½	1½	1	2½	31½
" " P.M. . . . .	2½	9½	1	1	1½	3½	19½
Total strippings for each cow	38½	76	33	11½	13½	26½	199
Mean strippings for each cow	4.25	9.5	4.12	1.27	1.7	2.9	—

It will be seen from the above figures that the stripping was much more efficiently carried out by the Murchland machine than by the Lawrence & Kennedy machine, the milking also was done in less time.

As already stated, neither machine efficiently fulfilled the requirements demanded; but as they both appeared capable of material improvement, the Judges recommended the offering of the prize for a future competition.

F. S. COURTNEY.

Broad Sanctuary Chambers, S.W.

## MISCELLANEOUS IMPLEMENTS EXHIBITED AT YORK.

WRITING in the widest sense, it may be said that there was nothing in the 1900 Exhibition of the Royal Agricultural Society of England entirely new to agriculture ; no such invention as would mark a fresh discovery in agricultural art, or any entirely new machines for exploiting the old fields of labour. There are, however, great numbers of agricultural machines and implements patented yearly of which no official cognisance can be taken, as their inventors do not bring them to notice at the various shows.

Other countries are now competing with Great Britain in the manufacture of agricultural machinery, and America especially, which appreciates to the full the value of advertisement by means of exhibition. America, too, is notably succeeding in the manufacture of agricultural machinery. This is not a matter of surprise. Her agricultural interests are enormous, her internal and export business huge, and the capital invested in the pursuit of agriculture immense.

The American mind is Gallic in its liveliness and Anglo-Saxon in its persistence. Washington Irving remarked of the States Americans : " The cumberers of the ground are few ; all work, none play." Invention is a business with them, and all that keen and restless minds can accomplish, backed by capital, which is always forthcoming for any apparently taking notion, is devoted to the practical benefit of agricultural mechanics. The result is already evident in England. American machines are steadily thrusting themselves to the front in the English market. In his report upon the miscellaneous implements exhibited at Maidstone last year, my colleague in judging this year's implements made, in this connection, the following noteworthy statement<sup>1</sup> : " A somewhat remarkable feature of many of the stands was the number of articles of foreign manufacture—chiefly American—which gave the impression that some of our leading firms were becoming Implement Agents rather than Implement Makers. It is to be hoped that the latter will

<sup>1</sup> Journal R.A.S.E., 3rd series, vol. x., 1899, p. 552.

endeavour to retain the old name, instead of allowing themselves to be supplanted with the manufactures of our Transatlantic cousins, though it cannot be denied that these possess very great

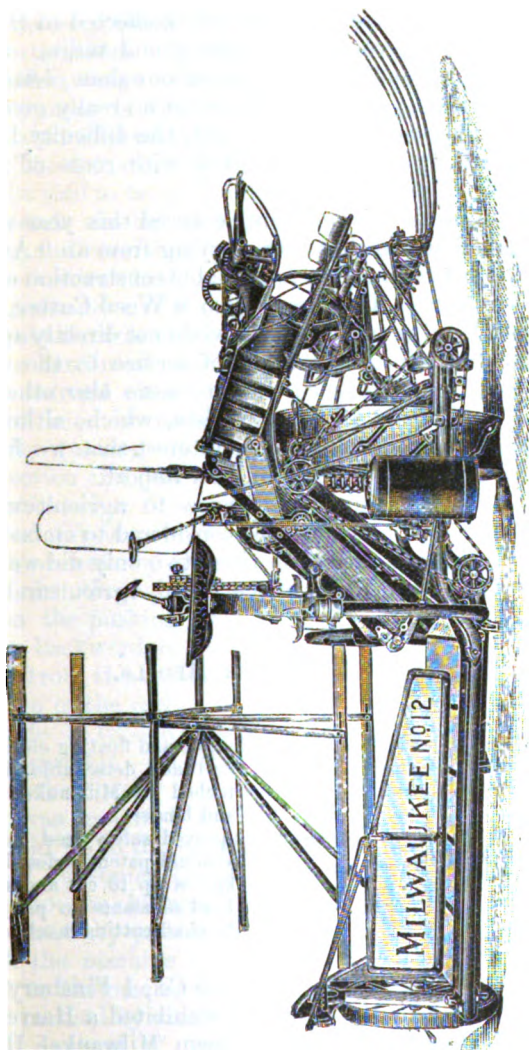


FIG. 1.—Milwaukee Harvester and Binder, with Flexible and Floating Elevator.

merit." It is indeed impossible to deny that the American machines are simpler in design and lighter in construction, whilst no less effective than their English rivals.

Nothing like the number of auto-motor machines expected after the exhibition of the first road van has since appeared, there being only one instance of a motor waggon. It would be a good thing if binders and reapers could be made to go by power, as a great saving in horse labour would be effected in this direction. A really effective turnip topping and tailing machine, also, would save about 8s. per acre in labour alone, setting aside the question of time. There is at present no really good implement for this purpose upon the market, the difficulty being the inability of present machinery to deal with roots of irregular size.

The forty-nine new implements entered this year were of a decidedly miscellaneous character, varying from an "Automatic Electrical Horse Feeder" to a remarkable construction entitled a "Motor Cultivator." There were also a Weed Cutter, a Stone Breaker, and a Road Scarifier, which, while not directly applicable to the needs of agriculture, are yet of service to the purposes for which they were designed. There were also other implements, of direct benefit to agriculturists, which, although not worthy of silver medals, are of such interest that we have considered them deserving of notice in this Report.

Of implements of distinct service to agricultural needs there were two which may fairly be considered to embody something new in principle, and upon these two only did we deem it fit to bestow the Silver Medal of the Royal Agricultural Society of England.

#### AWARDS OF SILVER MEDALS.

No. in Catalogue.	Exhibitor.	Nature of Implement.
3110	HUGH REID GRIFFIN & Co., 1 Finsbury Square, E.C.	Flexible and floating elevator, lever reel and detachable divider, attached to Milwaukee harvester and binder.
4113	KELSEY & Co., 41-45 Guernsey Road, Sheffield.	Improved safety feed rollers, provisional patent pedestal, to keep knives up to cut and allow any hard substance to pass, attached to chaff-cutting machine.

Article 3110.—*Hugh Reid Griffin & Co.*, 1 Finsbury Square, London, E.C. Price 42*l.*—This firm exhibited a Harvester and Binder manufactured by the well-known Milwaukee Harvester Company, Milwaukee, Wis., U.S.A., which was entered as a "new implement," the points entitling it to such description being (a) a modification in the elevator apron to minimise the chances of choking, (b) the method of actuating the vertical

horizontal motions of the reel by one lever. The machine is generally illustrated by fig. 1, whilst fig. 2 shows the details of the floating apron.

a) The latter, instead of extending as one apron from the bottom delivery board to the top of the machine, is now divided into two sections. At the point where the two sections join a considerable range of motion is provided, while the top end of the apron canvas is free to ride quite loose and to discharge any un-mulched corn on to the binding platform.

b) The actuating of the two motions of the reel by a lever is not to be said to be quite novel, as, by means of a supplemental dog catch similar to that used in connection with the retarding and reversing lever of a locomotive, one lever has been used to control both actions. In the present instance, however, the manner in which the motion is controlled appears to be novel. At the rear of the machine, convenient to the driver, is a handle of which

it can be turned either to the right hand or to the left hand.

By turning it in one direction and pushing the lever backward or forward a vertical lift is given to the reel, whereas by turning it in the opposite direction the pushing forward or backward of the reel controls the horizontal motion of the reel.

Article 4113.—*Kelsey & Co.*, 41–45 Guernsey Road, Sheffield. Price 41*l.*—In the Chaff-cutter, exhibited as a new implement, the novelty consisted in the manner in which the knife was mounted, so that in the ordinary way the knife would hold up to the mouth of the feed box, but in the event of a hard substance occurring it would pass through without doing any damage to the knives. This action was very satisfactorily demonstrated by passing a handful of large French wire nails through the machine several times, without the slightest disturbance to the machine or damage to the knives.

The method by which this result is obtained is exceedingly simple. Instead of the spindle carrying the knives being rotated without any end-on motion, as is usual in most machines, the spindle is held in what one may term a floating position by spiral springs acting in opposite directions (fig. 3), one of the springs naturally being set somewhat heavier than the

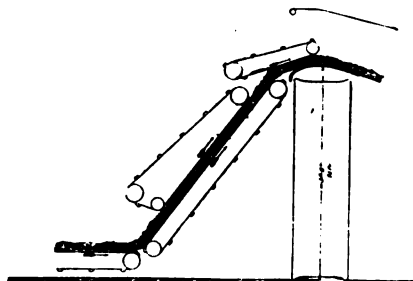


FIG. 2.—Diagram of Milwaukee Flexible and Floating Elevator.

other : these tend to keep the knives up to the face of the feed box, but if any obstruction should be met with the knives are free to move forward and allow it to pass, and are again brought up to their working position. Some little improvement had been made in the safety feed rollers, but the award of the Silver Medal was given for the knife adjustment.

#### OTHER MISCELLANEOUS IMPLEMENTS.

Article 1389.—*Marshall, Sons & Co., Gainsborough.* Price 125*l.*, in addition to 465*l.* for the road roller.—To meet the demands of District Surveyors, Messrs. Marshall have brought

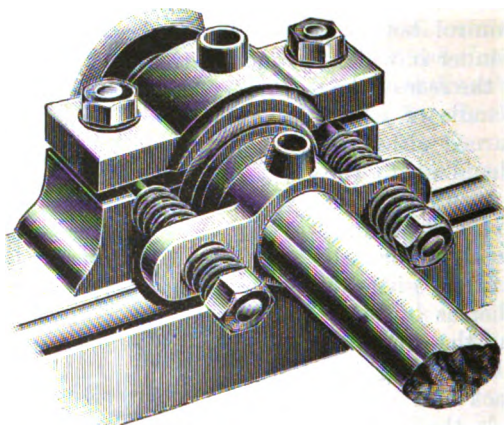


FIG. 3.—Pedestal of Chaff-cutter.

out as a new implement an improved Road Scarifier for breaking up macadamised roads, the doing of which by hand is not only tedious but frequently ineffective. The general arrangement of the machine and its mode of working will be understood from fig. 4 on the opposite page.

It will be seen that the scarifier is attached to the back end of the tender of the boiler, and that the weight and strain are equally distributed over the full width of the tender, which is built of extra thickness and strength. The scarifier works on a traversing platform, consequently it is capable of working right up to the gutter on either side of the road without turning the engine, and it can be so arranged that it will operate when the roller is running either backwards or forwards. The width of the cut varies from 12 inches to 15 inches and the depth from 2 inches to 3 inches, depending upon the nature of the road,

The depth is regulated by means of a handwheel and worm gear, which enables the scarifier to be raised from the ground when not required in work, and this arrangement of gear is self-locking in any position.

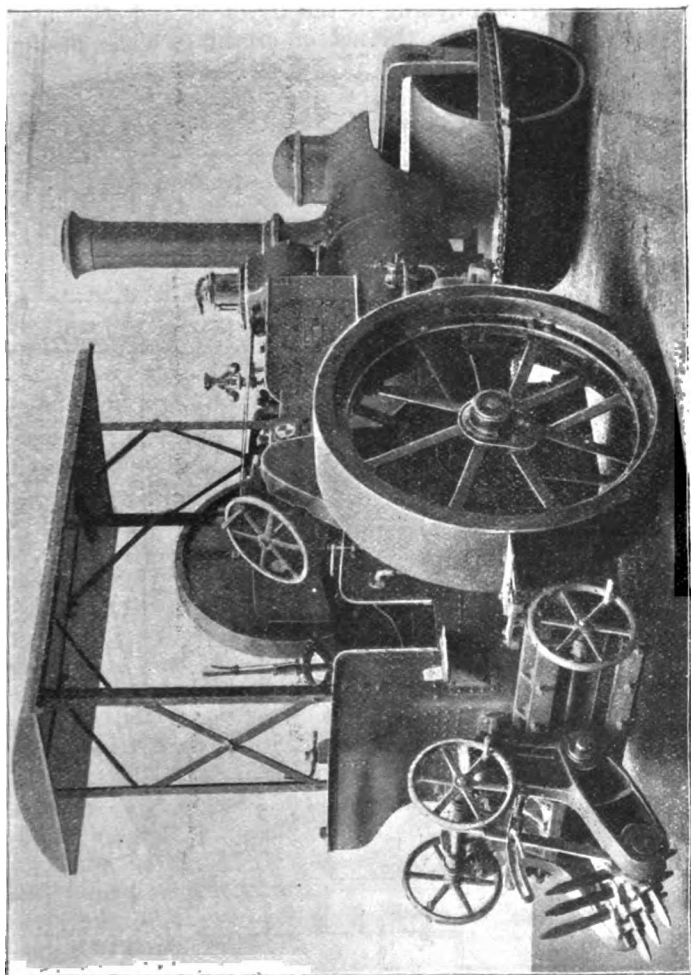


FIG. 4.—Marshall's Road Scarifier.

Article 4509.—*W. H. Baxter & Co., Leeds.* Price 225*l.*—In the new implement exhibited by Messrs. Baxter a novel and important departure is made in the design of stone breakers.

The driving shaft, instead of being supported in bearings in

the frame of the machine, is supported upon the jaw portion (shaded dark in the illustration, fig. 5), and the whole of the mechanism is in suspension from the shaft 1 and retained in working position by the retaining rod at point 13. It will be seen from this arrangement that the dead weight on the driving shaft, including the weight of the flywheels and other moving parts, actually assists in the act of crushing. The motion is

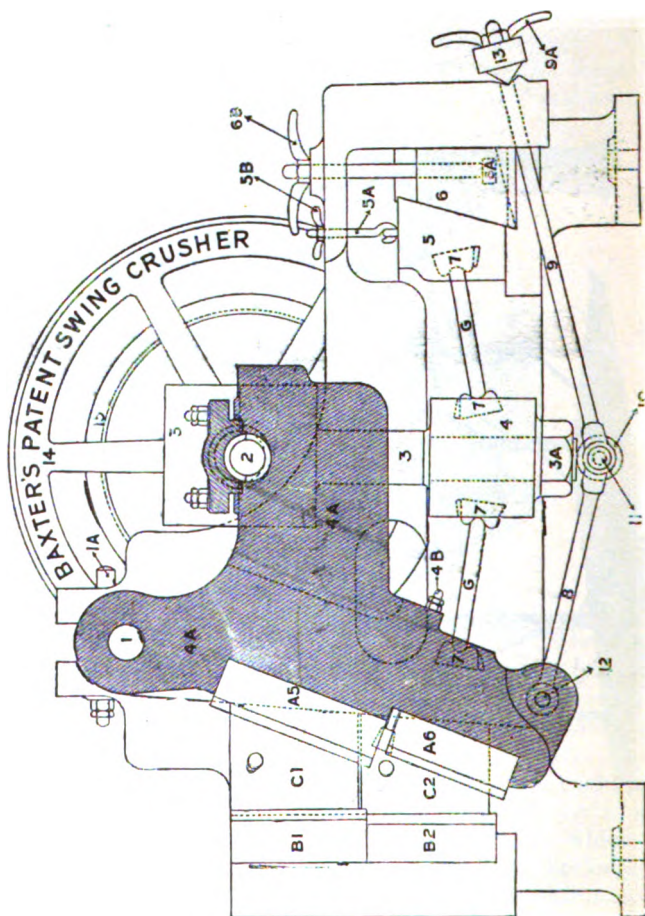


FIG. 5.—Baxter's Swing Stone Crusher.

most ingenious, and every care has been taken with the general design of the machine. It was found to work exceedingly freely. With the machine running at 220 revolutions per minute, on throwing off the belt it ran for 4 minutes 18 seconds, making

evolutions. We may expect to see the application of this to other machines.

Article 491.—*Henry Eckley*, Hampton, near Leominster.—**Gate Hinge** (price 4s. and 4s. 6d. each) for farm-yard and gates shown by this firm would appear to provide for every adjustment required by a gate. The accompanying illustrations (fig. 6) clearly how this is effected.

The upper hinge is made in two pieces, which are fastened together by a nut and bolt in an expanding slot, the altering position of which will set the top of the gate in any desired position: the range of this slot is sufficient to take a post of thickness between 3 and 5 inches. The side straps of the hinge are securely fastened to the gate by three bolts as

the lower hinge is provided with a similar expanding slot to the upper one, but instead of having the side straps rigidly fastened to the bar of the gate, it has a slot 5 inches long on the front face is provided. By this arrangement it is possible to adjust the position of the bolt in the slot: by moving the bolt

to the back of the hinge, the nose of the gate is lowered. By advancing it, it is raised. The position is maintained by tightening the bolt on to a washer fitting in the grooves of the side bar of hinge.

The hinges are very strong, being made of malleable iron, there is certainly a demand for an efficient hinge for the adjustment of a gate.

Article 4732.—*H. P. Sanderson & Co., Ltd.*, Kempston Bedford. **Weed Cutter** for water weeds. Price 25l.—The principle of this very useful machine is exactly that of the ordinary agricultural reaper applied to the cutting of water weeds. The result of working last season upon the Woburn lakes was a saving of cost of about 75 per cent. on the old method, and at the same time the work was far more effectively done. These machines can be made to cut at any depth desired below water,

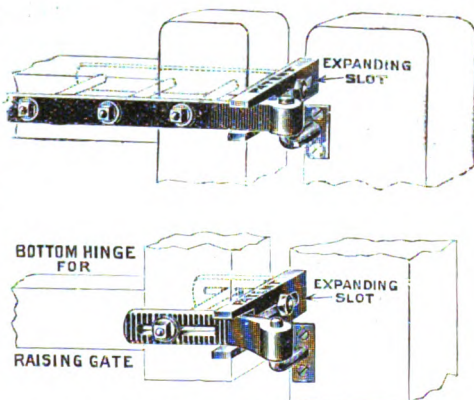


FIG. 6.—Eckley's Gate Hinge.

and the cutter-bar may be extended to any width at special prices. What is called the "Standard" size is found best for ordinary cases: it has a cutter-bar 5 feet wide and cuts 4 feet deep under the water.

The cutter-bar is self-adjusting to depth, so as to clear shoals, sunken trees, and such objects, by having shoes attached to its under side; and these, on coming in contact with any obstacle, cause the bar to rise until the obstacle is cleared, when it returns to its position. The knives can be raised clear of the water, or kept in position by means of a lever within the boat. The apparatus can be fixed to the gunwale or rowlocks of any boat or punt by clamping the brackets of the machine to them. It can be worked by hand or engine power. In the former case, where comparatively small areas have to be dealt with, the punt or boat can be rowed or otherwise propelled. One man can turn the cutter easily. Where large areas have to be dealt with, a special flat-bottomed boat, propelled by a stern wheel and driven by power, may be used with economy and advantage.

Article 1296.—*Hall, Crabtree & Heap*, 25 Price Street, Birkenhead, exhibited as a new implement a Refrigerator (patent) No. 44, improved Derby cold dry air, for which they claim that with a minimum of cost they maintain a minimum of temperature. Price 46*l.* 4*s.*

The refrigerator consists of an insulated chamber. The particular material mixed with the sawdust was maintained as a secret: it is therefore impossible to express any opinion about it. The tanks containing the freezing mixture were of large capacity compared with the area of the chamber, and a very efficient circulation of air was maintained round them. This is claimed as one of the special features of the machine.

Article 1518.—*G. F. Strawson*, 171A Queen Victoria Street, London, E.C. Price 6*l.* 6*s.*—In connection with spraying machinery this firm exhibits an Automatic Safety Gear for working the pump of a spraying machine, which gear can be fitted up, as shown in fig. 7, on any ordinary farm cart, and driven from the wheel of the same by fixing on the spokes three projections or bosses which actuate a lever which makes one stroke of the pump, the return stroke being effected by the tension of the horizontal spiral spring shown in the diagram: upon the adjustment of this spring depends the pressure at which the pumps will work.

The pump itself is exceedingly simple and accessible. The end covers are removable, and they contain the suction and delivery valves, which can thus be easily examined at any time.

Article 1023.—*Dairy Supply Co., Ltd.*, Museum Street, London, W.C. Prices from 1s. 6d.—Among the several exhibits of this company was a most conveniently arranged box

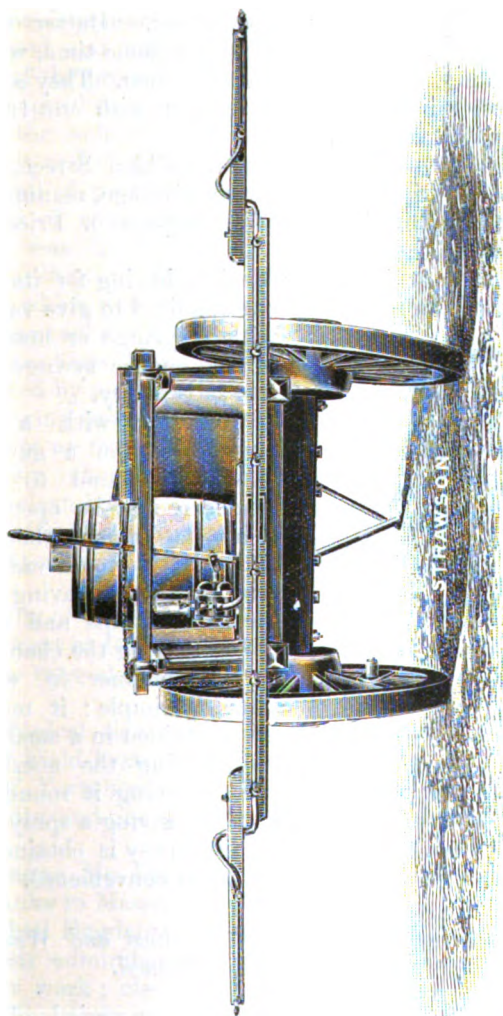


FIG. 7.—Strawson's Automatic Safety Gear for Spraying-Machine.

for the conveyance and storage of butter, termed the "Iceberg" Butter Carrier, Wateridge's patent. It consists of a strongly made wooden box with a series of tin partitions, made for any desired weight of butter. The way in which these tin partitions

are made constitutes the patent. The illustration (fig. 8) shows the construction.

The partitions readily take to pieces and can be easily cleaned, and it is impossible for the butter in any way to come in contact with the outer wooden box. Butter which had been stored in one of these boxes for some time, without any artificial cooling, was in excellent condition. They are made in several sizes, ranging from a 2 lb. box with one tray up to a 50 lb. box with five trays.

Article 3917.—*Sinclair & Co.*, 19 Eldon Street, Finsbury, London, E.C.—Triple-action Garden Syringe, manufactured by Benton & Stone, Birmingham (White's patent). Prices 10s. 6d., 15s., and 21s.

This is a most ingenious device, having for its object the superseding of the several nozzles required to give varying jets with a syringe or hose. As exhibited on the syringe its action was satisfactory.



FIG. 8.—"Iceberg" Butter Carrier.

Whether with a constant pressure, as on a garden hose, it will be found to act quite efficiently may be open to question; but should there be any difficulty, it would easily be got over by always having a tap on the branch pipe and closing it before making the change of jet.

The manner in which the change of jet is effected is extremely simple: it merely consists in having various-sized discs contained in a small chamber just behind the outlet nozzle. Holding the nozzle in one position will give a full way jet; turning it round slightly, one of the discs drops in front of it, giving a spray delivery; turning it round still farther, a fine spray is obtained. This, though a small thing, should be a great convenience.

*The Yorkshire College, Leeds, and the East and West Ridings Joint Agricultural Council.*

The exhibits on this stand were very varied, illustrating most of the sciences related to agriculture.

In connection with the sheep-breeding experiment at the Experimental Farm, Garforth, there were shown photographs of the rams, ewes, crossed lambs, and carcasses of cross-bred

fleeces of ten cross-bred hogs, and charts showing the effect of the qualities of the wool.

effect of the spraying of charlock, spurrey, wild m, and other weeds with solutions of sulphate of iron and was demonstrated at intervals during the week, and sprayed and unsprayed plants were on view, showing the process of the process.

geological exhibits comprised specimens of the rocks which the soils of Yorkshire are formed, a geological map of the county, and diagrams illustrating public water supplies, were all of great interest.

the food of wild birds in its relation to the farmer and the farmer was illustrated by a case containing contents of the crops, showing which birds were the enemies of the crops and which were their friends. The food of pheasants, young rooks, sparrows of various ages, corncrakes, and other birds was thus shown. The case also contained specimens of the food sucked by magpies, the castings of owls and kestrels, the castles' wing cases and bones of rats and mice from the old nests swept up from a barn frequented by owls.

in their veterinary museum the exhibits included specimens of the clean bones of the leg and foot of the horse, and of the side-bones, ring-bones, and spavins; ossified arteries and vessels; a model of a horse's foot; and various internal organs.

the results of seven hundred analyses of the milk of individual cows kept at Garforth were displayed on charts. On the other side were also samples of Garforth soil and analyses of the soil.

the biological department was represented by an exhibit named "Field Pests." Under this heading were shown a number of Yorkshire weeds and their seeds, a collection of field plants, and one of injurious insects.

my colleague, Mr. Bayntun Hippiusley, and I desire to offer our thanks to Messrs. G. H. Sanday, Howard P. Ryland, Marshall Dugdale, Stewards of the Implement Department for their admirable arrangements, which much tended to the success of our work; also to Mr. F. S. Courtney, Consulting Engineer to the Society, who with his assistants afforded us the benefit of technical assistance and advice. All the exhibitors have very kindly aided us in the difficult work of judging.

THOMAS STIRTON.

Implements Office, Woodbridge.

## THE AGRICULTURAL HOLDINGS ACT, 1900.

THIS Act, which is set out at length in the second part of the Appendix to this paper on pages 503 to 510, differs from the existing Agricultural Holdings Acts mainly in two respects. First, it applies to Scotland as well as England, whereas each of these countries has at present an Act to itself—there is a Scotch Agricultural Holdings Act 1883 as well as an English Act of the same year; and secondly, the Act is an amending Act simply, and must be read as if incorporated into the existing Acts. It does not, like the English Act of 1883, wholly repeal the existing Acts, but is to be construed, so far as it affects Agricultural Holdings in England with the English Act of 1883, and so far as it affects similar holdings in Scotland with the Scotch Act of the same year. In this paper I shall confine myself to the Act so far as it affects England, and shall not allude to it as it affects Scotland any further than to say that sec. 3 does not apply to Scotland at all, that sec. 8 applies to Scotland only, that sec. 10 directs how the Act is to apply to Scotland, sec. 12 repeals certain parts of the Scotch Act of 1883 and other Scotch Acts, and sec. 14 subsec. (3) directs that the Act, with the existing Scotch Acts, may be cited together as “The Agricultural Holdings (Scotland) Acts 1883 to 1900;” and that as regards Scotland as well as England the Act amends the respective Market Gardeners’ Compensation Acts relating to those countries.

During the time that the Bill for the new Act was passing through Parliament, many complaints were made both in the Houses of Parliament and out of them that the Bill was an amending Bill only, and did not consolidate the existing Statute Law relating to compensation for improvements on Agricultural Holdings. “Why, good gracious me,” said an old and tried friend of the farmers, on one occasion when the Bill was being discussed, “this Bill refers to five Acts of Parliament; I think it repeals 30 clauses in these different Acts, and alters about twelve other clauses partially repealed! Surely what we want is a consolidated Act,” and his remarks met with a loud chorus of approval. To meet complaints such as these I have endeavoured to piece the new Act and the 1883 Act together, so as to make one document which should show the existing Statute Law on this subject by itself and without reference to any other.

My readers must clearly understand that this patchwork of mine, which they will find in the first part of the Appendix to this paper, on pp. 490 to 503, is not an Act of Parliament, but merely the expression of my opinion of the way in which the new Act and the old Act when put together should be read. I have worked it out for the convenience of landlords, farmers, valuers, and others who are affected by the Acts, and to save them the trouble of referring to the different volumes of the Statutes in which the Acts are contained. For the sake of convenience as well as of brevity I have set out at length only those parts of the 1883 Act which are of general application, and referred merely to those parts which are less generally applicable—for instance, I have set out at length those parts which give tenants the right to compensation, but have referred merely to those parts which specially affect Crown, duchy, ecclesiastical, and charity lands. I have not noticed the Act of 1890, which relates to properties in mortgage only, and is unaltered by the new Act; and I have dealt with Market Gardens separately.

But I fear some of my readers may say “Yes, it is all very well for you to have set this piece of patchwork before us, but it is a complicated document, and we are not much, if any, wiser than we were before we read it; tell us, if you can, how the new Act has altered or improved the present position of landlords and tenants of agricultural land in England.” I will endeavour to do so as briefly as possible.

There are three additional improvements in respect of the making of which, without the consent of or notice to his landlord, a tenant is given a claim for compensation, viz.: (a) The consumption on the holding “by horses other than those regularly employed on the holding” of corn cake and feeding stuffs not produced on the holding; (b) “The consumption on the holding by cattle, sheep, or pigs, or by horses other than those regularly employed on the holding of corn, proved by satisfactory evidence to have been produced and consumed on the holding;” (c) “Laying down temporary pasture with clover, grass, lucerne, sainfoin, or other seeds sown more than two years prior to the determination of the tenancy.” The extension of the right to compensation for these three improvements has been very generally advocated during the last few years, and their inclusion in Part III. of the 1st Schedule to the Act will, I apprehend, be generally approved of.

The other alterations in the 1st Schedule are:—In Part I. the consent of the landlord is required to the “making or removal of permanent fences,” and not only to the “making of fences,” as in the old Schedule. This change seems proper,

for there is no necessity to require a landlord's consent to the making of a temporary fence, while it is right and proper that permanent fences (which may be boundaries of an estate) should not be made or removed without the consent of the owner of the land. The consent of the landlord is also required to "protecting young fruit trees," and "the erection of wirework in hop gardens." Part II. remains unchanged; while, "boning of land with undissolved bones" is excluded from Part III., it being considered, I apprehend, that such an operation is included in the item, "application to land of purchased artificial or other purchased manure." In the same part of the 1st Schedule to the item (20) "Claying of land" is added "or spreading blaes upon land," making this item run as it is in the existing Scotch Act. "Blaes" appear to be blue coloured clay or soft slate, so that "spreading blaes" would seem to be very much like what we call claying in England.

The next important alteration made by the new Act is the repeal of the 57th section of the 1883 Act, and the new enactment, sec. 1, subsec. (5). "Nothing in this section shall prejudice the right of a tenant to claim any compensation to which he may be entitled under custom, agreement, or otherwise, in lieu of any compensation provided by this section." This is a most important provision, and entirely alters the present position, for under the 57th section of the Act of 1883, compensation under that Act is exclusive, that is to say, a tenant cannot obtain compensation by custom or otherwise than in manner authorised by the Act, in respect of any improvement for which he is entitled to compensation under the Act. The alteration, I feel sure, is a change for the better, and will tend to make the Act much more popular; it will at all events make lawful that which is now done, though strictly unlawful, in very many parts of the country.

Another benefit in my opinion conferred by the new Act is the abolition of the notice of claim by the tenant and of the notice of counterclaim by the landlord. The notice had to be given two months at least before the determination of the tenancy, and according to evidence given before the last Royal Commission on Agriculture was regarded "as one great cause of the unpopularity of the Act." As Mr. Read said, "If a tenant made a claim under the Act it was a sort of declaration of war against the landlord," and "every possible dilapidation and default on the part of the tenant were hunted up and brought against him." No notice of claim will for the future be required, and the tenant has until the determination of his tenancy to make his claim, but he cannot make it afterwards, except the

claim relates to an improvement executed after that date while he lawfully remains in occupation of part of the holding, and in such case the claim must be made before he quits that part. This provision, which is contained in sec. 2, subsec. (2), and the provisions contained in subsec. (3) of the same section (which latter are too long to cite in full<sup>1</sup>) will, I think, be found most beneficial. They should go a long way towards destroying that state of war between the parties of which the notice of claim was the signal, and ought to place an arbitration under the Act on the same footing as the ordinary valuation made on a change of tenancy. Where the tenant's claim is referred to arbitration, he may, if he thinks fit and gives the prescribed notice to the landlord, require the arbitration to be extended to any claim for breach of contract or otherwise in respect of the holding which he may have against the landlord; and correlatively the landlord may, if he thinks fit, and gives the prescribed notice to the tenant, require the arbitration to be extended to any claim which he may have against the tenant in respect of any waste wrongfully committed or permitted by the tenant, or in respect of breach of contract or otherwise in respect of the holding. So that all matters in dispute between a landlord and outgoing tenant may in the future be referred to one and the same tribunal, and be made the subject of a single award, a result which cannot fail to be attended with advantage. Moreover, the concluding words of subsec. (3) will render ineffective the decision in *re Holmes and Formby*,<sup>2</sup> in which it was held that where a greater amount was awarded to the landlord in respect of waste and breaches of covenant committed by the tenant than was awarded to the tenant as compensation for improvements, the landlord could not recover the balance under the procedure given by the Act of 1883. For the future, the new Act provides that any sum awarded to be paid by a landlord or a tenant shall be recoverable in manner provided by the 1883 Act for the recovery of compensation, that is, upon order made by the Judge of the County Court.

Objection has been taken to the clause of the Act which enacts that "an arbitration shall, unless the parties otherwise agree, be before a single arbitrator." But it must be remembered that recourse to arbitration under the Act is not to be had until after failure of the parties to settle their differences between themselves, and in default of any agreement between them to submit to arbitration. It is not until both these

<sup>1</sup> See post, p. 485.

<sup>2</sup> See this case, which is reported in the Journal R.A.S.E., 3rd series, vol. vi., 1896, p. 182.

methods of settlement have failed that arbitration under the Act comes in, and then it is open to the parties *not* to have a single arbitrator. In everyday practice I apprehend the outgoing tenant will consult a valuer just as he does now in respect of acts of husbandry and such-like matters, adding to these matters any claim he may consider himself entitled to for compensation under the Act; and the landlord on his side will consult a valuer, and this action will be evidence that the parties do not wish to have a single arbitrator, and they can then express that intention in writing, and so "agree in writing that there be not a single arbitrator." And the two valuers can become the arbitrators under the Act, and proceed accordingly.

It would be tedious and out of place in the Journal to consider in detail the new provisions relating to procedure, which are for the most part contained in the second schedule to the new Act. Suffice it to say that speaking generally, the Board of Agriculture is substituted for the County Court as the authority to appoint an arbitrator or umpire in the cases where an official appointment is necessary, and to give further time for making an award when further time is required. But the County Court is the authority by which an arbitrator or umpire who misconducts himself can be removed, and by which an award in a like case, or where an arbitration or award has been improperly procured, may be set aside.

The award need no longer specify the amount awarded in respect of any particular improvement or improvements, but, on the application of either party, it must do so. The award in all cases will be final as regards facts, but in matters of law a case may be stated (and must on the direction of the County Court Judge) for the opinion of that Court, and from the opinion of that Court an appeal lies to the Court of Appeal but no further. The award must be in such form as may be prescribed by the Board of Agriculture, but the arbitrators or umpire are not required to use forms for proceedings in arbitrations under the Act which may be prescribed by the Board, but such forms "shall, if used, be sufficient." I am in a position to say that the Board will prepare and issue a form of Award in good time before the Act comes into operation, but that it is not proposed to issue any forms for proceedings in arbitrations under the Act until it is seen whether it would be of advantage for the Board to do so.

The 6th section of the 1883 Act is wholly repealed, and in lieu of the regulation it contained in reference to one of the reductions to be made in ascertaining the amount of compensation to be paid for the application of manures, or the consumption of feeding stuffs, the new Act (sec. 1, subsec. 4) enacts that

in such cases "there shall be taken into account the value of the manure required by the contract of tenancy or by custom to be returned to the holding in respect of any crops sold off or removed from the holding within the last two years of the tenancy or other less time for which the tenancy has endured, not exceeding the value of the manure which would have been produced by the consumption on the holding of the crops so sold off or removed." And the proviso in the same section of the 1883 Act restricting the landlord's right to compensation in respect of waste by the tenant or of breach by the tenant committed or permitted in relation to a matter of husbandry more than four years before the determination of the tenancy is not re-enacted.

Sec. 4 of the new Act confers a benefit on tenant farmers by giving them the property in and the right of removal of fixtures or buildings which they acquire, as well as the property in and right of removal of those which they affixed or erected themselves.

Sec. 5 confers upon landlords a statutory right of entry upon a holding for the purpose of ascertaining in what state it is; this right is always reserved in leases or agreements in writing, but is now for the first time made statutory.

By the 6th section of the Act, penal or higher rents or liquidated damages for the breach or non-fulfilment of a covenant or condition in a contract of tenancy to which the Act applies are abolished, and the landlord's right is restricted to the recovery of the damage actually suffered by him in consequence of such breach or non-fulfilment. But this restriction is not to apply to "any covenant or condition against breaking up permanent pasture, grubbing underwoods, or felling, cutting, lopping or injuring trees, or regulating the burning of heather." This alteration of the law appears just and reasonable, for while on the one hand the recovery of no more than the actual damage suffered meets the case of the breach of ordinary covenants such as those relating to everyday cultivation and sale of produce, yet, on the other hand, where it is impossible to estimate the damage suffered by a breach of a covenant, such as would be the case if in breach of a covenant not to break up rich pasture lands like the Leicestershire and Northamptonshire pastures, a tenant was to break them up, it is right and proper that he should be penalised for doing so.

*The Market Gardeners' Compensation Act, 1895.*—The only alteration that the new Act makes in this Act is to repeal the paragraphs numbered (2) and (3) in the 3rd section, and in lieu of them to substitute item (27) of the 1st Schedule to the new Act. This item is split up into five sub-divisions, of which (i)

(ii) (iii) and (v) are exactly the same as the corresponding sub-divisions of sec. (3) of the 1895 Act—but the new sub-division (iv) runs “Planting of asparagus, rhubarb and other vegetable crops which continue productive for two or more years,” instead of, as in the old sub-division (iv) “Planting of asparagus and other vegetable crops.”

*Commencement of the Act.*—The Agricultural Holdings Act, 1900, is to come into operation on January 1, 1901; and as regards any improvement made before that date the compensation payable for it is to be the same as could have been claimed if the new Act had not been passed, but is to be ascertained in the manner provided by the new Act.

S. B. L. DRUCE.

Lincoln's Inn.

## APPENDIX. PART I.

### THE AGRICULTURAL HOLDINGS (ENGLAND) ACT 1883, SO FAR AS NOW OPERATIVE, AS AMENDED BY THE AGRICULTURAL HOLD- INGS ACT 1900.

[*Note.*—The provisions of the new Act are printed in italics.]

#### PART I.

##### IMPROVEMENTS.

SEC. 1 of the 1883 Act is repealed and the following subsection of section 1 of the new Act is substituted for it, viz. :—

1. (1.) *Where a tenant has made on his holding any improvement comprised in the First Schedule to this Act he shall, subject as in the Agricultural Holdings (England) Act, 1883 (in this Act referred to as the principal Act) and in this Act mentioned, be entitled, at the determination of a tenancy, on quitting his holding to obtain from the landlord as compensation under the said Acts for the improvement such sum as fairly represents the value of the improvement to an incoming tenant. Provided always, that in estimating the value of any such improvement there shall not be taken into account, as part of the improvement made by the tenant, what is justly due to the inherent capabilities of the soil.*

Section 2 relates to improvements executed before the commencement of the Act of 1883, and therefore need not be set forth.

**AS TO IMPROVEMENTS EXECUTED AFTER THE COMMENCEMENT  
OF ACT.**

3. Compensation under this Act shall not be payable in respect of any improvement mentioned in the first part of the First Schedule to the *Act of 1900*, and executed after the commencement of this Act, unless the landlord, or his agent duly authorised in that behalf, has, previously to the execution of the improvement and after the passing of this Act, consented in writing to the making of such improvement, and any such consent may be given by the landlord unconditionally, or upon such terms as to compensation, or otherwise, as may be agreed upon between the landlord and the tenant, and in the event of any agreement being made between the landlord and the tenant, any compensation payable thereunder shall be deemed to be substituted for compensation under this Act.

4. Compensation under this Act shall not be payable in respect of any improvement mentioned in the second part of the First Schedule to the *Act of 1900*, and executed after the commencement of this Act, unless the tenant has, not more than three months and not less than two months before beginning to execute such improvement, given to the landlord, or his agent duly authorised in that behalf, notice in writing of his intention so to do, and of the manner in which he proposes to do the intended work, and upon such notice being given, the landlord and tenant may agree on the terms as to compensation or otherwise on which the improvement is to be executed, and in the event of any such agreement being made, any compensation payable thereunder shall be deemed to be substituted for compensation under this Act, or the landlord may, unless the notice of the tenant is previously withdrawn, undertake to execute the improvement himself, and may execute the same in any reasonable and proper manner which he thinks fit, and charge the tenant with a sum not exceeding five pounds per centum per annum on the outlay incurred in executing the improvement, or not exceeding such annual sum payable for a period of twenty-five years as will repay such outlay in the said period, with interest at the rate of three per centum per annum, such annual sum to be recoverable as rent. In default of any such agreement or undertaking, and also in the event of the landlord failing to comply with his undertaking within a reasonable time, the tenant may execute the improvement himself, and shall in respect thereof be entitled to compensation under this Act.

The landlord and tenant may, if they think fit, dispense with any notice under this section, and come to an agreement in a lease or otherwise between themselves in the same manner and of the same validity as if such notice had been given.

5. Where, in the case of a tenancy under a contract of tenancy current at the commencement of this Act, any agreement in writing or custom, or the *Agricultural Holdings (England) Act, 1875*, provides specific compensation for any improvement comprised in the First

Schedule to the Act of 1900 compensation in respect of such improvement, although executed after the commencement of this Act, shall be payable in pursuance of such agreement, custom, or Act of Parliament, and shall be deemed to be substituted for compensation under this Act.

Where in the case of a tenancy under a contract of tenancy beginning after the commencement of this Act, any particular agreement in writing secures to the tenant for any improvement mentioned, in the third part of the First Schedule to the Act of 1900, and executed after the commencement of this Act, fair and reasonable compensation, having regard to the circumstances existing at the time of making such agreement, then in such case the compensation in respect of such improvement shall be payable in pursuance of the particular agreement, and shall be deemed to be substituted for compensation under this Act.

The last preceding provision of this section relating to a particular agreement shall apply in the case of a tenancy under a contract of tenancy current at the commencement of this Act in respect of an improvement mentioned in the third part of the First Schedule to the Act of 1900, specific compensation for which is not provided by any agreement in writing, or custom, or the Agricultural Holdings Act, 1875.

Sections 6 to 16 inclusive, comprising REGULATIONS AS TO COMPENSATION FOR IMPROVEMENTS, and as to PROCEDURE, are repealed, and the following substituted for them :—

1. (3.) *In the ascertainment of the amount of the compensation payable to a tenant under the principal Act or this Act there shall be taken into account any benefit which the landlord has given or allowed to the tenant in consideration of the tenant executing the improvement.*

(4.) *In the ascertainment of the amount of the compensation payable to a tenant in respect of manures as defined by this Act, there shall be taken into account the value of the manure required by the contract of tenancy or by custom to be returned to the holding in respect of any crops sold off or removed from the holding within the last two years of the tenancy or other less time for which the tenancy has endured, not exceeding the value of the manure which would have been produced by the consumption on the holding of the crops so sold off or removed.*

2. (1.) *If a tenant claims to be entitled to compensation, whether under the principal Act or this Act, or under custom, agreement, or otherwise in respect of any improvement comprised in the First Schedule to this Act, and if the landlord and tenant fail to agree as to the amount and time and mode of payment of such compensation, the difference shall be settled by arbitration in accordance with the provisions, if any, in that behalf in any agreement between landlord and tenant, and in default of and subject to any such provisions by arbitration under this Act in accordance with the provisions set out in the Second Schedule to this Act.*

(2.) Any claim by a tenant for compensation under the principal Act or this Act in respect of any improvement comprised in the First Schedule to this Act shall not be made after the determination of the tenancy. Provided that where the claim relates to an improvement executed after the determination of the tenancy, but while the tenant lawfully remains in occupation of part of the holding, the claim may be made at any time before the tenant quits that part.

(3.) Where any claim by a tenant for compensation in respect of any improvement comprised in the First Schedule to this Act is referred to arbitration, and any sum is claimed to be due to the tenant from the landlord in respect of any breach of contract or otherwise in respect of the holding, or to the landlord from the tenant in respect of any waste wrongfully committed or permitted by the tenant, or in respect of breach of contract or otherwise in respect of the holding, the party claiming such sum may, if he thinks fit, by written notice to the other party given by registered letter or otherwise not later than seven days after the appointment of the arbitrator or arbitrators, require that the arbitration shall extend to the determination of the further claim, and thereupon the provisions of this section with respect to arbitration shall apply accordingly, and any sum awarded to be paid by a landlord or tenant shall be recoverable in manner provided by the principal Act for the recovery of compensation.

(4.) Where any claim which is referred to arbitration relates to an improvement executed or matter arising after the determination of the tenancy, but while the tenant lawfully remains in occupation of part of the holding, the arbitrator may, if he thinks fit, make a separate award in respect of such claim.

(5.) An arbitration shall, unless the parties otherwise agree, be before a single arbitrator.

17. In any case provided for by sections three, four, or five, if compensation is claimed under this Act, such compensation as under any of those sections is to be deemed to be substituted for compensation under this Act, if and so far as the same can, consistently with the terms of the agreement, if any, be ascertained by the referees or the umpire, shall be awarded in respect of any improvements thereby provided for.

Secs. 18 to 23 are also repealed, and in lieu of the last section, which related to appeals to a county court, the following subsection of section 2 of the new Act is substituted :—

(6.) If in any arbitration under this Act the arbitrator states a case for the opinion of the county court on any question of law, the opinion of the court on any question so stated shall be final, unless within the time and in accordance with the conditions prescribed by rules of the Supreme Court either party appeals to the Court of Appeal, from whose decision no appeal shall lie.

And the following subsection of section 2 is the substituted enactment relative to persons giving false evidence :—

(7.) Any person who wilfully and corruptly gives false evidence

*before an arbitrator or umpire in any arbitration under this Act shall be guilty of perjury, and may be dealt with, prosecuted, and punished accordingly.*

The following subsection of section 2 is new :—

(8.) *Subject to any provision contained in any agreement between landlord and tenant the Arbitration Act, 1889, shall not apply to any arbitration to which this Act applies.*

24. Where any money agreed or awarded to be paid for compensation, costs, or otherwise, is not paid within fourteen days after the time when it is agreed or awarded to be paid, it shall be recoverable, upon order made by the judge of the county court, as money ordered by a county court under its ordinary jurisdiction to be paid is recoverable.

Sec. 25, which contains provisions for the appointment of guardian, in cases where a landlord or tenant is an infant or of unsound mind, not so found by inquisition; and sec. 26, which contains provisions respecting married women, are not altered, but do not appear to be of sufficient general importance to be set forth at length.

27. The costs of proceedings in the county court under this Act shall be in the discretion of the court.

The Lord Chancellor may from time to time prescribe a scale of costs for those proceedings, and of costs to be taxed by the registrar of the court.

28. Any notice, request, demand, or other instrument under this Act may be served on the person to whom it is to be given, either personally or by leaving it for him at his last known place of abode in England, or by sending it through the post in a registered letter addressed to him there; and if so sent by post it shall be deemed to have been served at the time when the letter containing it would be delivered in ordinary course; and in order to prove service by letter it shall be sufficient to prove that the letter was properly addressed and posted, and that it contained the notice, request, demand, or other instrument to be served.

#### CHARGE OF TENANT'S COMPENSATION.

Sections 29, 30, 31, and 32 are not altered, except that the Board of Agriculture is substituted for the County Court as the authority from whom the charges to which the sections relate may be obtained, and except by the following subsections of section 3 of the new Act, viz. :—

(2.) *Where a charge may be made under the principal Act or this Act for compensation, the person making the award shall, at the request and cost of the party entitled to obtain the charge, certify the amount to be charged and the term for which the charge may properly be made, having regard to the time at which each improvement in respect of which compensation is awarded is to be deemed to be exhausted.*

(3.) *Sections twenty-nine, thirty, and thirty-one of the principal Act shall apply to any money paid by or due from a landlord to a tenant as compensation for any improvement comprised in the First Schedule to this Act, whether the compensation be claimed under this Act or under custom or agreement or otherwise.*

(4.) *A charge made by the Board of Agriculture pursuant to this section shall be a land charge within the meaning of the Land Charges Registration and Searches Act 1888, and may be registered accordingly.*

#### NOTICE TO QUIT.

33. Where a half year's notice, expiring with a year of tenancy, is by law necessary and sufficient for determination of a tenancy from year to year, in the case of any such tenancy under a contract of tenancy made either before or after the commencement of this Act, a year's notice so expiring shall by virtue of this Act be necessary and sufficient for the same, unless the landlord and tenant of the holding, by writing under their hands, agree that this section shall not apply, in which case a half year's notice shall continue to be sufficient; but nothing in this section shall extend to a case where the tenant is adjudged bankrupt, or has filed a petition for a composition or arrangement with his creditors.

#### FIXTURES.

34. Where after the commencement of this Act a tenant affixes to his holding or acquires any engine, machinery, fencing, or other fixture, or erects or acquires any building for which he is not under this Act or otherwise entitled to compensation, and which is not so affixed or erected, or acquired in pursuance of some obligation in that behalf or instead of some fixture or building belonging to the landlord, then such fixture or building shall be the property of and be removable by the tenant before or within a reasonable time after the termination of the tenancy.

Provided as follows :—

1. Before the removal of any fixture or building the tenant shall pay all rent owing by him, and shall perform or satisfy all other his obligations to the landlord in respect to the holding :
2. In the removal of any fixture or building the tenant shall not do any avoidable damage to any other building or other part of the holding :
3. Immediately after the removal of any fixture or building the tenant shall make good all damage occasioned to any other building or other part of the holding by the removal :
4. The tenant shall not remove any fixture or building without giving one month's previous notice in writing to the landlord of the intention of the tenant to remove it :

5. At any time before the expiration of the notice of removal the landlord, by notice in writing given by him to the tenant, may elect to purchase any fixture or building comprised in the notice of removal, and any fixture or building thus elected to be purchased shall be left by the tenant, and shall become the property of the landlord, who shall pay the tenant the fair value thereof to an incoming tenant of the holding; and any difference as to the value shall be settled by a reference under this Act, as in case of compensation (but without appeal).

Sections 35 to 39 of the 1883 Act relating to Crown, Duchy, Ecclesiastical, and Charity Lands remain unaltered except that the Board of Agriculture is substituted for the County Court as the authority by whom a charge on the holding for moneys paid by the Governors of Queen Anne's Bounty in respect of an improvement may be made.

#### RESUMPTION FOR IMPROVEMENTS, AND MISCELLANEOUS.

41. Where on a tenancy from year to year a notice to quit is given by the landlord with a view to the use of land for any of the following purposes:

The erection of farm labourers' cottages or other houses, with or without gardens;

The providing of gardens for existing farm labourers' cottages or other houses;

The allotment for labourers of land for gardens or other purposes;

The planting of trees;

The opening or working of any coal, ironstone, limestone, or other mineral, or of a stone quarry, clay, sand, or gravel pit, or the construction of any works or buildings to be used in connexion therewith;

The obtaining of brick earth, gravel, or sand;

The making of a watercourse or reservoir;

The making of any road, railway, tramroad, siding, canal, or basin, or any wharf, pier, or other work connected therewith; and the notice to quit so states, then it shall, by virtue of this Act, be no objection to the notice that it relates to part only of the holding.

In every such case the provisions of this Act respecting compensation shall apply as on determination of a tenancy in respect of an entire holding.

The tenant shall also be entitled to a proportionate reduction of rent in respect of the land comprised in the notice to quit, and in respect of any depreciation of the value to him of the residue of the holding, caused by the withdrawal of that land from the holding or by the use to be made thereof, and the amount of that reduction shall be ascertained by agreement or settled by a reference under this Act, as in case of compensation (but without appeal).

The tenant shall further be entitled, at any time within twenty-

eight days after service of the notice to quit, to serve on the landlord a notice in writing to the effect that he (the tenant) accepts the same as a notice to quit the entire holding, to take effect at the expiration of the then current year of tenancy ; and the notice to quit shall have effect accordingly.

42. Subject to the provisions of this Act in relation to Crown, duchy, ecclesiastical, and charity lands, a landlord, whatever may be his estate or interest in his holding, may give any consent, make any agreement, or do or have done to him any act in relation to improvements in respect of which compensation is payable under this Act which he might give, or make, or do, or have done to him if he were in the case of an estate of inheritance owner thereof in fee, and in the case of a leasehold possessed of the whole estate in the leasehold.

43. When, by any Act of Parliament, deed, or other instrument, a lease of a holding is authorised to be made, provided that the best rent, or reservation in the nature of rent, is by such lease reserved, then, whenever any lease of a holding is, under such authority, made to the tenant of the same, it shall not be necessary, in estimating such rent or reservation, to take into account against the tenant the increase (if any) in the value of such holding arising from any improvements made or paid for by him on such holding.

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## PART II.

### DISTRESS.

44. After the commencement of this Act it shall not be lawful for any landlord entitled to the rent of any holding to which this Act applies to distrain for rent, which became due in respect of such holding, more than one year before the making of such distress, except in the case of arrears of rent in respect of a holding to which this Act applies existing at the time of the passing of this Act, which arrears shall be recoverable by distress up to the first day of January 1885 to the same extent as if this Act had not passed.

Provided that where it appears that according to the ordinary course of dealing between the landlord and tenant of a holding the payment of the rent of such holding has been allowed to be deferred until the expiration of a quarter of a year or half a year after the date at which such rent legally became due, then for the purpose of this section the rent of such holding shall be deemed to have become due at the expiration of such quarter or half year as aforesaid, as the case may be, and not at the date at which it legally became due.

45. Where live stock belonging to another person has been taken in by the tenant of a holding to which this Act applies to be fed at a fair price agreed to be paid for such feeding by the owner of such stock to the tenant, such stock shall not be distrained by the landlord for rent where there is other sufficient distress to be found,

and if so distrained by reason of other sufficient distress not being found, there shall not be recovered by such distress a sum exceeding the amount of the price so agreed to be paid for the feeding, or if any part of such price has been paid exceeding the amount remaining unpaid, and it shall be lawful for the owner of such stock, at any time before it is sold, to redeem such stock by paying to the distrainer a sum equal to such price as aforesaid, and any payment so made to the distrainer shall be in full discharge as against the tenant of any sum of the like amount which would be otherwise due from the owner of the stock to the tenant in respect of the price of feeding: Provided always, that so long as any portion of such live stock shall remain on the said holding the right to distrain such portion shall continue to the full extent of the price originally agreed to be paid for the feeding of the whole of such live stock, or if part of such price has been *bonâ fide* paid to the tenant under the agreement, then to the full extent of the price then remaining unpaid.

Agricultural or other machinery which is the *bonâ fide* property of a person other than the tenant, and is on the premises of the tenant under a *bonâ fide* agreement with him for the hire or use thereof in the conduct of his business, and live stock of all kinds which is the *bonâ fide* property of a person other than the tenant, and is on the premises of the tenant solely for breeding purposes, shall not be distrained for rent in arrear.

**46. Where any dispute arises—**

- (a) in respect of any distress having been levied contrary to the provisions of this Act; or
- (b) as to the ownership of any live stock distrained, or as to the price to be paid for the feeding of such stock; or
- (c) as to any other matter or thing relating to a distress on a holding to which this Act applies:

such dispute may be heard and determined by the county court or by a court of summary jurisdiction, and any such county court or court of summary jurisdiction, may make an order for restoration of any live stock or things unlawfully distrained, or may declare the price agreed to be paid in the case where the price of the feeding is required to be ascertained, or may make any other order which justice requires: any such dispute as mentioned in this section shall be deemed to be a matter in which a court of summary jurisdiction has authority by law to make an order on complaint in pursuance of the Summary Jurisdiction Acts; but any person aggrieved by any decision of such court of summary jurisdiction under this section may, on giving such security to the other party as the court may think just, appeal to a court of general or quarter sessions.

**47. Where the compensation due under this Act, or under any custom or contract, to a tenant has been ascertained before the landlord distrains for rent due, the amount of such compensation may be set off against the rent due, and the landlord shall not be entitled to distrain for more than the balance.**

48. An order of the county court or of a court of summary jurisdiction under this Act shall not be quashed for want of form, or be removed by certiorari or otherwise into any superior court.

Sections 49 to 52 and the second Schedule relating to the same subject were repealed by the Law of Distress Amendment Act, 1888, which in effect extended the provisions contained in them to all classes of holdings.

### PART III.

#### GENERAL PROVISIONS.

Section 53 prescribed the date of the commencement of the Act.

54. Nothing in this Act shall apply to a holding that is not either wholly agricultural or wholly pastoral, or in part agricultural, and as to the residue pastoral, or in whole or in part cultivated as a market garden, or to any holding let to the tenant during his continuance in any office, appointment, or employment held under the landlord.

55. Any contract, agreement, or covenant made by a tenant, by virtue of which he is deprived of his right to claim compensation under this Act in respect of any improvement mentioned in the First Schedule to the Act of 1900 (except an agreement providing such compensation as is by this Act permitted to be substituted for compensation under this Act), shall, so far as it deprives him of such right, be void both at law and in equity.

56. Where an incoming tenant has, with the consent in writing of his landlord, paid to an outgoing tenant any compensation payable under or in pursuance of this Act in respect of the whole or part of any improvement, such incoming tenant shall be entitled on quitting the holding to claim compensation in respect of such improvement or part in like manner, if at all, as the outgoing tenant would have been entitled if he had remained tenant of the holding, and quitted the holding at the time at which the incoming tenant quits the same.

Sec. 57 is repealed—it provided that compensation under the Act of 1883 was to be exclusive, but now under sec. 1, subsec. (5) of the new Act, *nothing in this section shall prejudice the right of a tenant to claim any compensation to which he may be entitled under custom, agreement, or otherwise, in lieu of any compensation provided by this section.*

58. A tenant who has remained in his holding during a change or changes of tenancy shall not thereafter on quitting his holding at the determination of a tenancy be deprived of his right to claim compensation in respect of improvements by reason only that such improvements were made during a former tenancy or tenancies, and not during the tenancy at the determination of which he is quitting.

59. Subject as in this section mentioned, a tenant shall not be entitled to compensation in respect of any improvements, other than manures as defined by this Act, begun by him, if he holds from year to year, within one year before he quits his holding, or at any time after he has given or received final notice to quit, and, if he holds as a lessee, within one year before the expiration of his lease.

A final notice to quit means a notice to quit which has not been waived or withdrawn, but has resulted in the tenant quitting his holding.

The foregoing provisions of this section shall not apply in the case of any such improvement as aforesaid—

- (1.) Where a tenant from year to year has begun such improvement during the last year of his tenancy, and, in pursuance of a notice to quit thereafter given by the landlord, has quitted his holding at the expiration of that year; and
- (2.) Where a tenant, whether a tenant from year to year or a lessee, previously to beginning any such improvement, has served notice on his landlord of his intention to begin the same, and the landlord has either assented or has failed for a month after the receipt of the notice to object to the making of the improvement.

60. Except as in this Act expressed, nothing in this Act shall take away, abridge, or prejudicially affect any power, right, or remedy of a landlord, tenant, or other person vested in or exercisable by him by virtue of any other Act or law, or under any custom of the country, or otherwise, in respect of a contract of tenancy or other contract, or of any improvements, waste emblements, tillages, away-going crops, fixtures, tax, rate, title rentcharge, rent, or other thing.

61. In this Act—

“Contract of tenancy” means a letting of or agreement for the letting land for a term of years, or for lives, or for lives and years, or from year to year :

A tenancy from year to year under a contract of tenancy current at the commencement of the Act shall for the purposes of this Act be deemed to continue to be a tenancy under a contract of tenancy current at the commencement of this Act until the first day on which either the landlord or tenant of such tenancy could, the one by giving notice to the other immediately after the commencement of this Act, cause such tenancy to determine, and on and after such day as aforesaid shall be deemed to be a tenancy under a contract of tenancy beginning after the commencement of this Act :

“Determination of tenancy” means the cesser of a contract of tenancy by reason of effluxion of time, or from any other cause :

“Landlord” in relation to a holding means any person for the time being entitled to receive the rents and profits of any holding :

"Tenant" means the holder of land under a landlord for a term of years, or for lives, or for lives and years, or from year to year :

"Tenant" includes the executors, administrators, assigns, legatees, devisees, or next-of-kin, husband, guardian, committee of the estate or trustees in bankruptcy of a tenant, or any person deriving title from a tenant ; and the right to receive compensation in respect of any improvement made by a tenant shall enure to the benefit of such executors, administrators, assigns, and other persons as aforesaid :

"Holding" means any parcel of land held by a tenant :

"County court," in relation to a holding, means the county court within the district whereof the holding or the larger part thereof is situate :

"Person" includes a body of persons and a corporation aggregate or sole :

"Live stock" includes any animal capable of being distrained.

The definition of "manures" in this section is repealed and the following substituted for it, viz. :—

9. (1.) *References to "manures" in the principal Act and this Act shall be construed as references to the improvements numbered twenty-three, twenty-four, and twenty-five in Part III. of the First Schedule to this Act.*

The designations of landlord and tenant shall continue to apply to the parties until the conclusion of any proceedings taken under or in pursuance of this Act in respect of compensation for improvements, or under any agreement made in pursuance of this Act.

The remaining sections 62-64 of the 1883 Act need not be cited, but the following sections of the new Act, which contain quite new provisions, must be :—

5. *The landlord of a holding or any person authorised by him may at all reasonable times enter on the holding, or any part of it, for the purpose of viewing the state of the holding.*

6. *Notwithstanding any provision in a contract of tenancy making the tenant liable to pay a higher rent or other liquidated damages in the event of any breach or nonfulfilment of a covenant or condition, a landlord shall not be entitled to recover, by distress or otherwise, any sum in consequence of any breach or nonfulfilment of any such covenant or condition in excess of the damage actually suffered by him in consequence of the breach or nonfulfilment. Provided that this section shall not apply to any covenant or condition against breaking up permanent pasture, grubbing underwoods, or felling, cutting, lopping, or injuring trees, or regulating the burning of heather.*

7. *The compensation in respect of an improvement made before this Act comes into operation shall be such (if any) as could have been claimed if this Act had not been passed, but shall be ascertained in the manner provided by this Act.*

THE FIRST SCHEDULE OF THE 1883 Act is repealed, and the FIRST SCHEDULE of the new Act substituted for it:—

### PART I.

#### IMPROVEMENTS TO WHICH CONSENT OF LANDLORD IS REQUIRED.

- (1.) Erection or enlargement of buildings.
- (2.) Formation of silos.
- (3.) Laying down of permanent pasture.
- (4.) Making and planting of osier beds.
- (5.) Making of water meadows or works of irrigation.
- (6.) Making of gardens.
- (7.) Making or improving of roads or bridges.
- (8.) Making or improving of watercourses, ponds, wells, or reservoirs, or of works for the application of water power or for supply of water for agricultural or domestic purposes.
- (9.) Making or removal of permanent fences.
- (10.) Planting of hops.
- (11.) Planting of orchards or fruit bushes.
- (12.) *Protecting young fruit trees.*
- (13.) Reclaiming of waste land.
- (14.) Warping or weiring of land.
- (15.) Embankments and sluices against floods.
- (16.) *The erection of wirework in hop gardens.*

[*N.B.—This part is subject as to market gardens to the provisions of Part III.*]

### PART II.

#### IMPROVEMENT IN RESPECT OF WHICH NOTICE TO LANDLORD IS REQUIRED.

- (17.) Drainage.

### PART III.

#### IMPROVEMENTS IN RESPECT OF WHICH CONSENT OF OR NOTICE TO LANDLORD IS NOT REQUIRED.

- (18.) Chalking of land.
- (19.) Clay-burning.
- (20.) Claying of land, or spreading blaes upon land.
- (21.) Liming of land.
- (22.) Marling of land.
- (23.) Application to land of purchased artificial or other purchased manure.
- (24.) Consumption on the holding by cattle, sheep, or pigs, or by horses other than those regularly employed on the holding, of corn, cake, or other feeding-stuff not produced on the holding.
- (25.) *Consumption on the holding by cattle, sheep, or pigs, or by horses other than those regularly employed on the holding, of corn proved by satisfactory evidence to have been produced and consumed on the holding.*
- (26.) *Laying down temporary pasture with clover, grass, lucerne, sainfoin, or other seeds sown more than two years prior to the determination of the tenancy.*

(27.) *In the case of a holding as to which section three of the Market Gardeners' Compensation Act, 1895 (58 & 59 Vict., c. 27) applies—*

- (i.) *Planting of standard or other fruit trees permanently set out ;*
- (ii.) *Planting of fruit bushes permanently set out ;*
- (iii.) *Planting of strawberry-plants ;*
- (iv.) *Planting of asparagus, rhubarb, and other vegetable crops which continue productive for two or more years ;*
- (v.) *Erection or enlargement of buildings for the purpose of the trade or business of a market gardener.*

## APPENDIX. PART II.

[*Notes.*—The marginal notes are printed in italics.]

### THE AGRICULTURAL HOLDINGS ACT, 1900.

[£3 & 64 VICT. CH. 50.]

AN ACT TO AMEND THE LAW RELATING TO AGRICULTURAL HOLDINGS. [8TH AUGUST 1900.]

BE it enacted by the Queen's most Excellent Majesty, by and with the advise and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

#### 1. *Right of tenant to compensation for improvements.*—

(1.) Where a tenant has made on his holding any improvement comprised in the First Schedule to this Act he shall, subject as in the Agricultural Holdings (England) Act, 1883, 46 & 47 Vict. c. 61 (in this Act referred to as the principal Act), and in this Act mentioned, be entitled, at the determination of a tenancy, on quitting his holding to obtain from the landlord as compensation under the said Acts for the improvement such sum as fairly represents the value of the improvement to an incoming tenant. Provided always, that in estimating the value of any such improvement there shall not be taken into account, as part of the improvement made by the tenant, what is justly due to the inherent capabilities of the soil.

(2.) References in the principal Act to the First Schedule to that Act shall be construed as references to the First Schedule to this Act.

(3.) In the ascertainment of the amount of the compensation payable to a tenant under the principal Act or this Act there shall be taken into account any benefit which the landlord has given or allowed to the tenant in consideration of the tenant executing the improvement.

(4.) In the ascertainment of the amount of the compensation payable to a tenant in respect of manures as defined by this Act, there shall be taken into account the value of the manure required by the contract of tenancy or by custom to be returned to the holding in respect of any crops sold off or removed from the holding

within the last two years of the tenancy or other less time for which the tenancy has endured, not exceeding the value of the manure which would have been produced by the consumption on the holding of the crops so sold off or removed.

(5.) Nothing in this section shall prejudice the right of a tenant to claim any compensation to which he may be entitled under custom, agreement, or otherwise, in lieu of any compensation provided by this section.

2. *Settlement of differences by arbitration.*—(1.) If a tenant claims to be entitled to compensation, whether under the principal Act or this Act, or under custom, agreement, or otherwise, in respect of any improvement comprised in the First Schedule to this Act, and if the landlord and tenant fail to agree as to the amount and time and mode of payment of such compensation, the difference shall be settled by arbitration in accordance with the provisions, if any, in that behalf in any agreement between landlord and tenant, and in default of and subject to any such provisions by arbitration under this Act in accordance with the provisions set out in the Second Schedule to this Act.

(2.) Any claim by a tenant for compensation under the principal Act or this Act in respect of any improvement comprised in the First Schedule to this Act shall not be made after the determination of the tenancy. Provided that where the claim relates to an improvement executed after the determination of the tenancy, but while the tenant lawfully remains in occupation of part of the holding, the claim may be made at any time before the tenant quits that part.

(3.) Where any claim by a tenant for compensation in respect of any improvement comprised in the First Schedule to this Act is referred to arbitration, and any sum is claimed to be due to the tenant from the landlord in respect of any breach of contract or otherwise in respect of the holding, or to the landlord from the tenant in respect of any waste wrongfully committed or permitted by the tenant, or in respect of breach of contract or otherwise in respect of the holding, the party claiming such sum may, if he thinks fit, by written notice to the other party given by registered letter or otherwise not later than seven days after the appointment of the arbitrator or arbitrators, require that the arbitration shall extend to the determination of the further claim, and thereupon the provisions of this section with respect to arbitration shall apply accordingly and any sum awarded to be paid by a landlord or tenant shall be recoverable in manner provided by the principal Act for the recovery of compensation.

(4.) Where any claim which is referred to arbitration relates to an improvement executed or matter arising after the determination of the tenancy, but while the tenant lawfully remains in occupation of part of the holding, the arbitrator may, if he thinks fit, make a separate award in respect of such claim.

(5.) An arbitration shall, unless the parties otherwise agree, be before a single arbitrator.

(6.) If in any arbitration under this Act the arbitrator states a case for the opinion of the county court on any question of law, the opinion of the court on any question so stated shall be final, unless within the time and in accordance with the conditions prescribed by rules of the Supreme Court either party appeals to the Court of Appeal, from whose decision no appeal shall lie.

(7.) Any person who wilfully and corruptly gives false evidence before an arbitrator or umpire in any arbitration under this Act shall be guilty of perjury, and may be dealt with, prosecuted, and punished accordingly.

(8.) Subject to any provision contained in any agreement between landlord and tenant the Arbitration Act, 1889 (52 & 53 Vict. c. 49), shall not apply to any arbitration to which this Act applies.

**3. Land charges.**—(1.) The powers of the county court under the principal Act with respect to charges shall be exercised by the Board of Agriculture, and accordingly the Board of Agriculture shall be substituted for the county court in sections twenty-nine, thirty, thirty-one, thirty-two, and thirty-nine of that Act.

(2.) Where a charge may be made under the principal Act or this Act for compensation, the person making the award shall, at the request and cost of the party entitled to obtain the charge, certify the amount to be charged and the term for which the charge may properly be made, having regard to the time at which each improvement in respect of which compensation is awarded is to be deemed to be exhausted.

(3.) Sections twenty-nine, thirty, and thirty-one of the principal Act shall apply to any money paid by or due from a landlord to a tenant as compensation for any improvement comprised in the First Schedule to this Act, whether the compensation be claimed under this Act or under custom or agreement or otherwise.

(4.) A charge made by the Board of Agriculture pursuant to this section shall be a land charge within the meaning of the Land Charges Registration and Searches Act, 1888 (51 & 52 Vict. c. 51), and may be registered accordingly. This subsection shall not apply to Scotland.

**4. Fixtures and buildings.**—The provisions of section thirty-four of the principal Act shall apply to a fixture or building acquired by a tenant in like manner as they apply to a fixture or building affixed or erected by a tenant.

**5. Power of entry.**—The landlord of a holding or any person authorised by him may at all reasonable times enter on the holding, or any part of it, for the purpose of viewing the state of the holding.

**6. Penal rents and liquidated damages.**—Notwithstanding any provision in a contract of tenancy making the tenant liable to pay a higher rent or other liquidated damages in the event of any breach

or nonfulfilment of a covenant or condition, a landlord shall not be entitled to recover, by distress or otherwise, any sum in consequence of any breach or nonfulfilment of any such covenant or condition in excess of the damage actually suffered by him in consequence of the breach or nonfulfilment. Provided that this section shall not apply to any covenant or condition against breaking up permanent pasture, grubbing underwoods, or felling, cutting, lopping, or injuring trees, or regulating the burning of heather.

7. *Improvements executed before Act comes into operation.*—The compensation in respect of an improvement made before this Act comes into operation shall be such (if any) as could have been claimed if this Act had not been passed, but shall be ascertained in the manner provided by this Act.

8. *Notice of termination of tenancy.*—From and after the passing of this Act notice of termination of tenancy under section twenty-eight of the Agricultural Holdings (Scotland) Act, 1883 (46 & 47 Vict. c. 62), may be given in the same manner as a notice of removal under section six of the Removal Terms (Scotland) Act, 1886 (49 & 50 Vict. c. 50).

9. *Interpretation.*—(1.) References to “manures” in the principal Act and this Act shall be construed as references to the improvements numbered twenty-three, twenty-four, and twenty-five in Part III. of the First Schedule to this Act.

(2.) This Act shall be construed as one with the principal Act.

10. *Application to Scotland.*—In the application of this Act to Scotland—

(1.) References to the principal Act and to sections twenty-nine, thirty, thirty-two, and thirty-four thereof shall be construed as references to the Agricultural Holdings (Scotland) Act, 1883 (46 & 47 Vict. c. 92), and to sections twenty-four, twenty-five, twenty-six, and thirty thereof respectively. References to sections thirty-one and thirty-nine of the principal Act shall not apply :

(2.) A reference to the Arbitration Act, 1889, shall be construed as a reference to the Arbitration (Scotland) Act, 1894 (57 & 58 Vict. c. 18), and a reference to the Market Gardeners’ Compensation Act, 1895, shall be construed as a reference to the Market Gardeners’ Compensation (Scotland) Act, 1897 (60 & 61 Vict. c. 29) :

(3.) The expression “either division of the Court of Session” shall be substituted for “Court of Appeal,” “sheriff” for “county court” or “judge of a county court,” “auditor of the sheriff court” for “registrar of the county court,” “Act of Sederunt” for “Rules of the Supreme Court,” “arbitrer” and “arbiters” for “arbitrator” and “arbitrators,” “oversman” for “umpire,” “deterioration” for “waste” and “expenses” for “costs” :

(4.) Any award or agreement as to compensation, and any other award under this Act, may be competently recorded for execution in the books of council and session or sheriff court books, and shall be enforceable in like manner as a recorded decree arbitral.

(5.) Where any jurisdiction committed by the principal Act or this Act to the sheriff is exercised by the sheriff-substitute there shall be no appeal to the sheriff.

11. *Extent of Act.*—This Act shall not extend to Ireland.

12. *Repeal.*—The enactments specified in the Third Schedule to this Act are hereby repealed to the extent mentioned in the third column of that schedule.

13. *Commencement of Act.*—This Act shall come into operation on the first day of January one thousand nine hundred and one.

14. *Short titles.*—(1.) This Act may be cited as the Agricultural Holdings Act, 1900.

(2.) The Agricultural Holdings (England) Act, 1883, the Tenants' Compensation Act, 1890 (53 & 54 Vict. c. 57), the Market Gardeners' Compensation Act, 1895 (58 & 59 Vict. c. 27), and this Act, may be cited together as the Agricultural Holdings (England) Acts, 1883 to 1900.

(3.) The Agricultural Holdings (Scotland) Act, 1883, the Market Gardeners' Compensation (Scotland) Act, 1897, and this Act may be cited together as the Agricultural Holdings (Scotland) Acts, 1883 to 1900.

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## SCHEDULES.

### FIRST SCHEDULE.

As this Schedule is printed in full at p. 502 it is not necessary to reprint it here.

### SECOND SCHEDULE.

#### RULES AS TO ARBITRATION.

#### PART I.

##### ARBITRATION BEFORE A SINGLE ARBITRATOR.

1. *Appointment of Arbitrator.*—A person agreed upon between the parties, or in default of agreement nominated by the Board of Agriculture on the application in writing of either of the parties, shall be appointed arbitrator.

2. If a person appointed arbitrator dies, or is incapable of acting, or for seven days after notice from either party requiring him to act fails to act, a new arbitrator may be appointed as if no arbitrator had been appointed.

3. Neither party shall have power to revoke the appointment of the arbitrator without the consent of the other party.

4. Every appointment notice, revocation, and consent under this part of these rules must be in writing.

5. *Time for Award.*—The arbitrator shall make and sign his award within twenty-eight days of his appointment or within such longer period as the Board of Agriculture may (whether the time for making the award has expired or not) direct.

6. *Removal of Arbitrator.*—Where an arbitrator has misconducted himself the county court may remove him.

7. *Evidence.*—The parties to the arbitration, and all persons claiming through them respectively, shall, subject to any legal objection, submit to be examined by the arbitrator, on oath or affirmation, in relation to the matters in dispute, and shall, subject as aforesaid, produce before the arbitrator all samples, books, deeds, papers, accounts, writings, and documents, within their possession or power respectively which may be required or called for, and do all other things which during the proceedings the arbitrator may require.

8. The arbitrator shall have power to administer oaths, and to take the affirmation of parties and witnesses appearing, and witnesses shall, if the arbitrator thinks fit, be examined on oath or affirmation.

9. *Statement of Case.*—The arbitrator may at any stage of the proceedings, and shall, if so directed by the judge of a county court (which direction may be given on the application of either party), state in the form of a special case for the opinion of that court any question of law arising in the course of the arbitration.

10. *Award.*—The arbitrator shall on the application of either party specify the amount awarded in respect of any particular improvement or improvements, and the award shall fix a day not sooner than one month nor later than two months after the delivery of the award for the payment of money awarded for compensation, costs, or otherwise, and shall be in such form as may be prescribed by the Board of Agriculture.

11. The award to be made by the arbitrator shall be final and binding on the parties and the persons claiming under them respectively.

12. The arbitrator may correct in an award any clerical mistake or error arising from any accidental slip or omission.

13. When an arbitrator has misconducted himself, or an arbitration or award has been improperly procured, the county court may set the award aside.

14. *Costs.*—The costs of and incidental to the arbitration and award shall be in the discretion of the arbitrator, who may direct to and by whom and in what manner these costs or any part thereof are to be paid, and the costs shall be subject to taxation by the registrar of the county court on the application of either party, but that taxation shall be subject to review by the judge of the county court.

15. The arbitrator shall, in awarding costs, take into consideration the reasonableness or unreasonableness of the claim of either party, either in respect of amount or otherwise, and any unreasonable demand for particulars or refusal to supply particulars, and generally all the circumstances of the case, and may disallow the costs of any witness whom he considers to have been called unnecessarily, and any other costs which he considers to have been incurred unnecessarily.

16. *Forms.*—Any forms for proceedings in arbitrations under this Act which may be prescribed by the Board of Agriculture shall, if used, be sufficient.

## PART II.

### ARBITRATION BEFORE TWO ARBITRATORS OR AN UMPIRE.

1. *Appointment of Arbitrators and Umpire.*—If the parties agree in writing that there be not a single arbitrator, each of them shall appoint an arbitrator.

2. If before award one of two arbitrators dies or is incapable of acting, or for seven days after notice from either party requiring him to act fails to act, the party appointing him shall appoint another arbitrator.

3. Notice of every appointment of an arbitrator by either party shall be given to the other party.

4. If for fourteen days after notice by one party to the other to appoint an arbitrator, or another arbitrator, the other party fails to do so, then, on the application of the party giving notice, the Board of Agriculture shall appoint a person to be an arbitrator.

5. Where two arbitrators are appointed, then (subject to the provisions of these rules) they shall, before they enter on the arbitration, appoint an umpire.

6. If before award an umpire dies, or is incapable of acting, or for seven days after notice from either party requiring him to act fails to act, the arbitrators may appoint another umpire.

7. If for seven days after request from either party the arbitrators fail to appoint an umpire, or another umpire, then, on the application of either party, the Board of Agriculture shall appoint a person to be the umpire.

8. Neither party shall have power to revoke an appointment of an arbitrator without the consent of the other.

9. Every appointment, notice, request, revocation, and consent under this part of these rules shall be in writing.

10. *Time for Award.*—The arbitrators shall make and sign their award in writing within twenty-eight days after the appointment of the last appointed of them, or on or before any later day to which the arbitrators, by any writing signed by them, may enlarge the time for making the award, not being more than forty-nine days from the appointment of the last appointed of them.

11. If the arbitrators have allowed their time or extended time to expire without making an award, or have delivered to either party or to the umpire a notice in writing stating that they cannot agree, the umpire may forthwith enter on the arbitration in lieu of the arbitrators.

12. The umpire shall make and sign his award within one month after the original or extended time appointed for making the award of the arbitrators has expired.

13. The time for making an award may from time to time be extended by the Board of Agriculture, whether the time for making the award has expired or not.

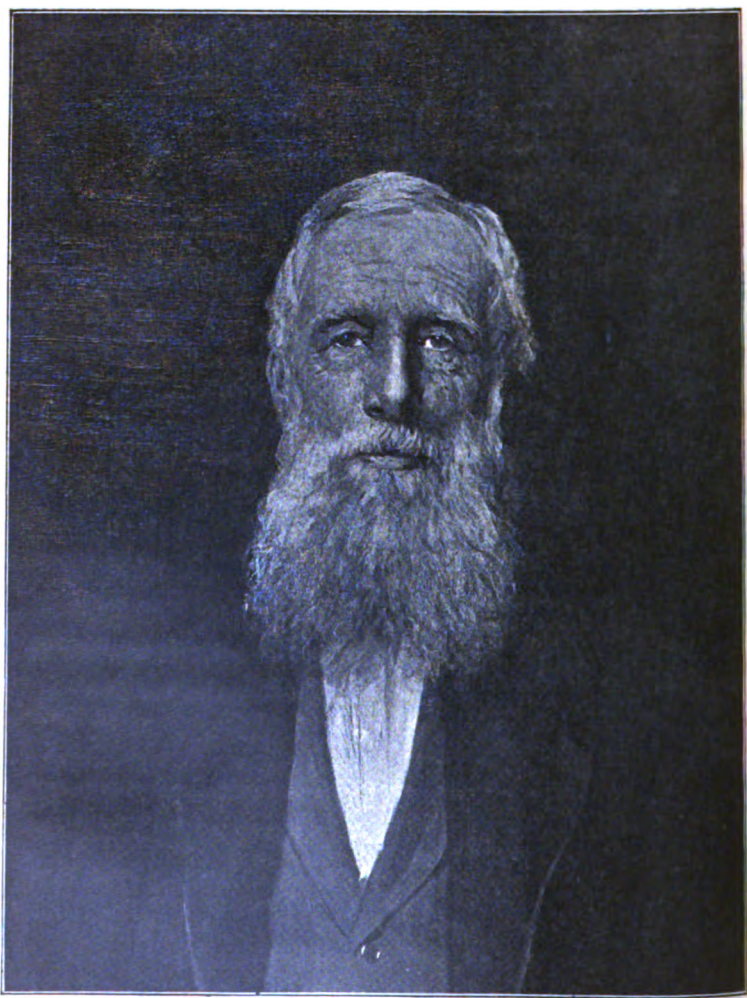
14. *Removal of Arbitrator, Evidence, Statement of Case, Award, Costs, Forms.*—The provisions of Part I. of these rules as to the removal of an arbitrator, the evidence, the statement of a case, the award, costs, and forms shall apply to an arbitration in accordance with this Part as if the expression "arbitrator" whenever used in those provisions included two arbitrators or an umpire, as the case may require.

## THIRD SCHEDULE.

## ENACTMENTS REPEALED.

Session and chapter	Short title	Extent of repeal
46 & 47 Vict. c. 61.	The Agricultural Holdings (England) Act, 1883	Section one. Sections six to sixteen. Section seventeen from "and the award shall" to the end of the section. Sections eighteen to twenty-three. In section twenty-four the words "or ordered on appeal" and the words "or ordered." Section twenty-nine from "where an award has been made" to "improvement will." Section fifty-seven. The definition of "manures" in section sixty-one. The First Schedule.
46 & 47 Vict. c. 62.	The Agricultural Holdings (Scotland) Act, 1883.	Section one. Sections six to eight. Sections eleven to fifteen. Section sixteen from the beginning thereof to "within the county," and from "and the award shall" to the end of the section. Sections seventeen to twenty. In section twenty-one the words "or ordered on appeal," and the words "or ordered." Section twenty-four from "where an award has been made" to "improvement will." Section thirty-eight. The Schedule.
52 & 53 Vict. c. 20.	The Agricultural Holdings (Scotland) Act, 1889.	The whole Act.
58 & 59 Vict. c. 27.	The Market Gardeners' Compensation Act, 1895.	In section three the paragraphs numbered (2) and (3).
60 & 61 Vict. c. 22.	The Market Gardeners' Compensation (Scotland) Act, 1897.	In section three the paragraphs numbered (2) and (3).





*Hubert Herkomer, R.A., pinxit.*

*J. B. Lawes*

SIR JOHN BENNET LAWES, Bart., F.R.S.

Born December 28, 1814.

Died August 31, 1900.

## In Memoriam

SIR JOHN BENNET LAWES, BART.

ON the last day of August 1900, Sir John Bennet Lawes passed peacefully away at his ancestral home. He was so hale and active until quite recently that it seemed likely he would live into the next century. This, however, was not to be, and the nineteenth century, with which his name and his work will be inseparably associated, claims him. Through his death the Royal Agricultural Society has to mourn the loss of one of its best friends and the oldest member of its Council, whilst Agriculture loses one of the greatest benefactors it has ever had.

Born on December 28, 1814, in the old Manor-house at Rothamsted, Herts, where nearly 86 years later he died, the deceased baronet was the son of the late Mr. John Bennet Lawes, whom he succeeded in the paternal estates in 1822, at the early age of eight. After leaving Eton he proceeded to Oxford, and passed some time at Brasenose College. His inclinations, however, were not much in the direction of classical study, and he shortly found himself in more congenial surroundings in the chemical laboratory of Dr. Antony Todd Thomson, at University College, London. On entering into possession of his hereditary property at Rothamsted in 1834, he at once began experiments upon plants growing in pots, the investigations being subsequently extended to the field. One of the most striking results observed in these early days was the excellent effect produced upon the turnip crop by dressing it with mineral phosphates that had been treated with sulphuric acid. At once grasping the importance of this discovery, Mr. Lawes, as he was then, obtained in 1842 a patent for the manufacture of superphosphate, and thus laid the foundation of a great industry.

In the following year was taken the decisive step of establishing at Rothamsted a properly equipped agricultural experiment station. Simultaneously, Mr. Lawes secured the

co-operation of a young chemist, Dr. (now Sir) J. Henry Gilbert, and the association which was thus commenced fifty-seven years ago has been attended by the happiest results, as the numerous scientific memoirs that have issued year after year from Rothamsted amply testify.

Two main lines of inquiry have been followed, the one relating to plants, the other to animals. In the former case the method of procedure has been to grow some of the most important crops of rotation, each separately, year after year, for many years in succession on the same land, without manure, with farmyard manure, and with a great variety of chemical manures; the same description of manure being, as a rule, applied year after year on the same plot. Experiments on an actual course of rotation, without manure, and with different manures, have also been made. Wheat, barley, oats, beans, clover and other leguminous plants, turnips, sugar beet, mangels, potatoes, and grass crops have thus been experimented upon. Incidentally there have been extensive sampling and analysing of soils, investigations into rainfall and the composition of drainage waters, inquiries into the amount of water transpired by plants, and experiments on the assimilation of free nitrogen. Lest any misunderstanding should arise as to the attitude taken up concerning the last-named subject, it may be useful to quote the following from the Memoranda of the Rothamsted Experiments, 1900 (p. 7):—

Experiments were commenced in 1857, and conducted for several years in succession, to determine whether plants assimilate free or uncombined nitrogen, and also various collateral points. Plants of the gramineous, the leguminous, and of other families, were operated upon. The late Dr. Pugh took a prominent part in this inquiry. The conclusion arrived at was that our agricultural plants do not themselves directly assimilate the free nitrogen of the air by their leaves.

In recent years, however, the question has assumed quite a new aspect. It now is—whether the free nitrogen of the atmosphere is brought into combination under the influence of micro-organisms, or other low forms, either within the soil, or in symbiosis with a higher plant, thus serving indirectly as a source of nitrogen to plants of a higher order. Considering that the results of Hellriegel and Wilfarth on this point were, if confirmed, of great significance and importance, it was decided to make experiments at Rothamsted on somewhat similar lines. Accordingly, a preliminary series was undertaken in 1888; more extended series were conducted in 1889 and in 1890; and the investigation was continued up to the commencement of the year 1895. Further experiments relating to certain aspects of the subject were commenced in 1898, and are still in progress. The results have shown that, when a soil growing leguminous plants is infected with appropriate organisms, there is a development of the so-called leguminous nodules on the roots of the plants, and, coincidentally, increased growth, and gain of nitrogen.

The experiments with farm animals began in 1847, and have been continued at intervals nearly to the present time. Amongst the points that have been investigated are the following:—

1. The amount of food, and of its several constituents, consumed (a) in relation to a given live-weight of animal within a given time, (b) to produce a given amount of increase in live-weight.

2. The proportion, and relative development, of the different organs, or parts, of different animals.

3. The proximate and ultimate composition of the animals in different conditions as to age and fatness, and the probable composition of their increase in live weight during the fattening process.

4. The composition of the solid and liquid excreta (the manure) in relation to that of the food consumed.

5. The loss or expenditure of constituents by respiration and the cutaneous exhalations—that is, in the mere sustenance of the living meat-and-manure-making machine.

6. The yield of milk in relation to the food consumed to produce it; and the influence of different descriptions of food on the quantity, and on the composition, of the milk.

Incidentally, the results obtained from the inquiries just enumerated have furnished data essential to the consideration of such problems as (a) the sources in the food of the fat produced in the animal body; (b) the characteristic demands of the animal body—for nitrogenous or non-nitrogenous constituents of food—in the exercise of muscular power; (c) the comparative characters of animal and vegetable food in human dietaries.

Amongst the field experiments there is, perhaps, nothing of more universal interest than the field—known as Broadbalk Field—in which wheat has been grown for fifty-seven years in succession, without manure, with farmyard manure, and with various artificial manures. The results show that, unlike leguminous crops such as beans or clover, wheat may be successfully grown for many years in succession on ordinary arable land, provided suitable manures be applied, and the land be kept clean. Even without manure, the average produce over forty-six years, 1852–1897, was nearly thirteen bushels per acre, or more than the average yield of the whole of the United States of America, including their rich prairie lands—in fact, about the average yield per acre of the wheat lands of the whole world. Mineral manures alone give very little increase, nitrogenous manures alone considerably more than mineral manures alone, but the mixture of the two considerably more

than either separately. In one case, indeed, the average produce by mixed mineral and nitrogenous manure was more than that by the annual application of farmyard manure; and in seven out of the ten cases in which such mixtures were used the average yield per acre was from over two to over eight bushels more than the average yield of the United Kingdom (which is rather less than twenty-eight bushels of 60 lb. per bushel) under ordinary rotation. It is estimated that the reduction in yield of the unmanured plot over the forty years, 1852-91, after the growth of the crops without manure during the eight preceding years, was, provided it had been uniform throughout, equivalent to a decline of one-sixth of a bushel from year to year due to exhaustion—that is, irrespectively of fluctuations due to season. It is related that a visitor from beyond the Atlantic, talking to Sir John Lawes in Broadbalk Field, said, “Americans have learnt more from this field than from any other agricultural experiment in the world.”

Another field experiment of singular interest is that relating to the mixed herbage of permanent meadow, for which seven acres of old grass land were set apart in Rothamsted Park in 1856. Of the twenty plots into which this land is divided, two have been left without manure from the commencement, two have received ordinary farmyard manure continuously, whilst the remainder have each received a different description of artificial or chemical manure, the same being, except in special cases, applied year after year on the same plot. No one can inspect this field during the growing season without being impressed by the striking evidence it affords of the influence of different manurial dressings. So much, indeed, does the character of the herbage vary from plot to plot that the effect may fairly be described as kaleidoscopic. Repeated analyses have shown how greatly both the botanical constitution and the chemical composition of the mixed herbage vary according to the description of manure applied. They have further shown how dominant is the influence of season. To such an extent, it may be added, is this the case that a given quantity of gross produce of the mixed herbage may be one thing in one season, and quite another in another season, both as to the proportion of the different species composing it, and as to their condition of development and maturity.

About 130 separate papers or reports on the Rothamsted Experiments have been published, most of them in the joint names of Sir John Lawes and Sir Henry Gilbert. More than one-third of these have been given to the world through the

medium of this Journal, in which the earliest paper to appear was that on "Agricultural Chemistry" in Vol. VIII. (1st series), 1847, and the latest, that on "The Growth of Sugar-Beet and the Manufacture of Sugar in the United Kingdom," in Vol. IX. (3rd series), 1898. These two dates embrace a period of fifty-two years. Of papers relating to experiments with animals, the first dealt with "Sheep Feeding and Manure," and was published in Vol. X. (1st series) in 1849; the last was on "The Feeding of Animals for the Production of Meat, Milk, and Manure, and for the Exercise of Force" in Vol. VI. (3rd series), 1895. Other subjects dealt with in this Journal include turnip culture (1847); the amount of water given off by plants during their growth (1850); agricultural chemistry, specially in relation to the mineral theory of Baron Liebig (1851 and 1863); the comparative fattening qualities of different breeds of sheep (Hampshire and Sussex Downs, 1851; Cotswolds, 1852; Leicesters and Cross-breds, 1855); pig-feeding (1853); the Holkham wheat experiments (1855); the growth of wheat by the Lois Weedon system (1856); the growth of barley continuously on the same land (1857, 1873); experiments with different manures on permanent meadow land (1858, 1859, 1863); observations on the recently-introduced manufactured foods for agricultural stock (1858); experiments on the growth of red clover by different manures (1860); the composition of oxen, sheep, and pigs, and of their increase whilst fattening (1860); experiments on the feeding of sheep and on the fattening of oxen (1861, 1862); the Rodmersham wheat experiments (1862); the utilisation of town sewage (1863); experiments on the growth of wheat for many years in succession upon the same land (1864, 1884); the home produce, imports, and consumption of wheat (1868, 1880, 1893); effects of the drought of 1870 on some of the experimental crops at Rothamsted (1871); the valuation of unexhausted manures (1875, 1885, 1891); our climate and our wheat crops (1880); the amount and composition of the rain and drainage waters collected at Rothamsted (1881, 1882, 1883); the history of a field newly laid down to permanent grass (1889); the food of our agricultural crops (1890); the sources of the nitrogen of our leguminous crops (1891); allotments and small holdings (1892); rotation of crops (1894); the depression of corn prices, and the production of wheat in some of the chief exporting countries of the world (1896); the Royal Commission on Agricultural Depression, and the valuation of unexhausted manures (1897); and the valuation of the manures

obtained by the consumption of foods for the production of milk (1898).

Voluminous papers have appeared in the Philosophical Transactions of the Royal Society, notably those upon the "Agricultural, Botanical, and Chemical Results of Experiments on the Mixed Herbage of permanent Grass-land, conducted for many years in succession on the same Land"—the agricultural results in 1880, the botanical results in 1882, and the chemical results (section 1) in 1900. Through the same medium were published, in 1859 and 1883, the reports upon an experimental inquiry into the composition of some of the animals fed and slaughtered as human food. To the Journal of the Chemical Society papers were contributed on the composition of the ash of wheat grain and wheat straw (1884), on the composition of soils (1884, 1885), and on other subjects. Observations on rainfall, percolation, and evaporation at Rothamsted appeared in the Proceedings of the Institution of Civil Engineers in 1891. Two reports were presented to Parliament, one in 1865 on the sewage of towns, in connection with a Royal Commission of which Mr. Lawes was a member; and one in 1866 on experiments undertaken, by order of the Board of Trade, to determine the relative values of unmalted and malted barley as food for stock.

The foregoing summary of papers is far from exhaustive, but it is illustrative of the many-sided activity of the founder of the Rothamsted Experiment Station. Sir John Lawes did not often appear as a lecturer, but mention may be made of his papers read before the London Farmers' Club, on exhaustion of the soil in relation to landlords' covenants and the valuation of unexhausted improvements (1870), and on the more frequent growth of barley on heavy land (1875). In 1870 he addressed the Maidstone Farmers' Club on scientific agriculture with a view to profit, and in 1879 he gave a lecture to the East Berwickshire Agricultural Association on the question—"Is higher farming a remedy for lower prices?" He was an earnest advocate of the system of selling cattle by live weight, and his useful book of "Tables for estimating Dead Weight and Value of Cattle from Live Weight" has long been included amongst the publications of the Royal Agricultural Society. In the autumn of 1862, and every year since, Sir John Lawes sent to "The Times" a letter containing his estimate of the produce of the wheat crop in the United Kingdom for the current year, and this letter was annually anticipated with much interest by agricultural readers and others. A few years ago the Rothamsted papers were collected

and bound up in three quarto and six (now seven) octavo volumes, and presented to various national institutions throughout the world.

The unique feature of Rothamsted—which is now the oldest agricultural experiment station in the world—is the long unbroken continuity of the investigations. It would have been nothing less than a national calamity had these ceased at the death of their founder. Sir John Lawes must have felt this, for he foresaw it, and with laudable munificence and admirable public spirit set aside a sum of 100,000*l.* for their permanent continuance. The fund is administered by the Lawes Agricultural Trust Committee,<sup>1</sup> the work of which began ten years ago and now goes on uninterruptedly despite the lamentable death of the donor.

Sir John Lawes was elected a Member of the Royal Agricultural Society in 1846, and a Governor in 1878. He was elected to a seat on the Council on May 22, 1848, became a Vice-President on December 11, 1878, and a Trustee on June 24, 1891. As the time for celebrating in 1898 the Jubilee of the Rothamsted experiments drew near, he was approached with the view of his occupying, in conjunction with that auspicious event, the office of President of the Royal Agricultural Society, a position he would no doubt have accepted and adorned but for advancing years and increasing deafness, which the veteran experimenter pleaded as an excuse for declining the honour which the Society was anxious to bestow. Sir John Lawes always took a warm and active interest in the experimental investigations carried on by the Society, and it need hardly be said that his advice relating to the inauguration and development of the Woburn Experiment Station was invaluable.

The many honours that were bestowed upon the late baronet were significant of the public appreciation of the great work which he had voluntarily undertaken. In 1854 he was elected a Fellow of the Royal Society, and in 1867 that distinguished body awarded the Royal Medal jointly to himself and Dr. Gilbert. In presenting this signal mark of distinction the President, Sir Edward Sabine, stated that Messrs. Lawes and Gilbert had been engaged for the last twenty-four years in a systematic series of researches upon Agricultural Chemistry, with a view of determining, by exact experiments, the principles, chemical and physiological, which are involved in the general and fundamental processes of successful agriculture. After

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<sup>1</sup> For the constitution and functions of this Committee, see *Journal R.A.S.E.* 3rd series, vol. vii. 1896, pp. 324-332.

enumerating the several lines of inquiry that were being pursued, he concluded with the words :—

It may be sufficient to sum up these remarks by stating that the various inquiries to which a brief reference has been made have been conducted with a skill, perseverance, and success which have placed their authors, by general consent, at the head of those who have pursued this important branch of experimental inquiry.

In February 1894, the Albert Gold Medal of the Society of Arts was presented by His Royal Highness, the Prince of Wales, on behalf of the Society, both to Sir John Lawes and to Sir Henry Gilbert “for their joint services to scientific agriculture, and notably for the researches which, throughout a period of fifty years, have been carried on by them at the Experimental Farm, Rothamsted.” Various foreign governments and agricultural or scientific societies bestowed upon Mr. Lawes tokens of their appreciation of his work. Nor were academical honours wanting, for in 1877 the University of Edinburgh conferred upon him the degree of LL.D., Oxford made him D.C.L. in 1892, and two years later Cambridge placed his name upon its D.Sc. roll. In the year 1882 Mr. Lawes was created a baronet in recognition of his services to Agriculture.

Two incidents in the career of the late baronet are of exceptional interest to agriculturists. The one occurred in 1854, the other in 1893. In the earlier year a considerable sum of money was raised by subscription in order to present to Mr. Lawes a testimonial in recognition of the services he had rendered to British Agriculture. The proposal of the committee was to purchase a service of plate, but at the suggestion of the intended recipient the amount subscribed was devoted to a purpose of greater utility. At the commencement of the regular experiments in 1843 an old barn had been fitted up as a laboratory, but had long since been found inadequate to meet the requirements. Consequently the fund raised in 1854 was expended in the erection of a new laboratory, which continues in service to-day. The formal presentation took place in July, 1855, and Mr. Lawes, in returning thanks, made *inter alia* the following remarks :—

I will now explain to you to what purpose we intend to devote your building, and show you to what extent science is most likely to be beneficial to agriculture. The great chemists of old had an opinion that science could do but little in aid of agriculture . . . If you consult works on agriculture previous to 1840, you will find no mention of the terms commonly used now. The French and Germans were the first to apply the science, and they made progress in the chemistry of agriculture. Agriculture as practised in Great

Britain in the present day is a very different process, requiring more skill and capital, than agriculture as practised in other countries . . . I must explain that the object of these investigations is not exactly to enable me to put money into my pocket, but to give you the knowledge by which you may be able to put money into yours. Science is not to do away with a rotation of crops, but to enable you to judge of the properties of all your several crops in rotation, and whether it would be better, under certain circumstances, to grow a second, third, or even fourth crop on the same land, or to follow your usual course . . . When investigations such as these have occupied our attention many years, we are led to regard them in some way as our children, and are unwilling to desert them or leave them destitute at the time of our death. This infant of mine, for which you have built this magnificent abode, combines with the helplessness of a babe the appetite of a giant. When, some twelve years ago, I delivered it into the arms of its present nurse, Dr. Gilbert, it was struggling for an existence. Under his tender management it has arrived at its present thriving condition. The interest in its welfare is not confined to this immediate neighbourhood, but extends even to foreign countries. . . So great is the amount of accumulated matter which I have not hitherto published that I consider it would take at least five years to place it all before the public. I have, therefore, although the subject is surrounded by many difficulties, provided that in the event of my death these investigations shall be still carried on, and the reports of what we have already done placed before the public for a term of at least five or seven years. A variety of circumstances prevented me doing more than this ; but I cannot conceive that the agriculturists of this country, who have shown so great a sympathy with the experiments I have carried on, will ever allow the building to fall into disuse. I should be most ungrateful were I to omit this opportunity of stating how greatly I am indebted to those gentlemen whose lives are devoted to the conduct and management of my experiments. To Dr. Gilbert more especially I consider a debt of gratitude is due from myself and from every agriculturist in Great Britain. . . . Gentlemen, to you who have left your several important occupations to assemble here to-day, as well as to those who have subscribed to the testimonial but are unable to be present, I return my most sincere thanks. The scientific investigations which I have carried on will henceforth assume an importance in my eyes not hitherto belonging to them. Whether they are eventually to become the guiding star to agriculturists, or to sink into insignificance before others more grand and comprehensive, my gratitude to you will be the same ; and a remembrance of your kindness to me to-day will be engraven in my heart until my eyes shall become dim, and my memory shall cease to serve.

The second incident, in 1893, arose out of the public desire to fittingly celebrate the Jubilee of the Rothamsted Experiments. Accordingly, at a meeting convened by the late Duke of Westminster, as President of the Royal Agricultural Society, and held on March 1, 1893, the Prince of Wales in the chair, it was resolved "that some public recognition should be made of the invaluable services rendered to Agriculture by Sir John Lawes and Dr. Gilbert." In the course of the speech made by His Royal Highness, the objects of the movement were tersely stated thus :—

All those who are interested in the progress of agricultural knowledge, and especially in the application of chemistry to the cultivation of crops and the feeding of stock, must be aware of the extreme importance of the valuable series of experiments so long carried on at Rothamsted by Sir John Bennet Lawes. These experiments were commenced in the year 1843, so that the current year will witness the conclusion of no less than half a century's investigations, which have been conducted during the lifetime of their founder. During the whole of this period, moreover, Dr. Gilbert has been associated with Sir John Lawes in the work of experimental research.

The Rothamsted experiments have from the commencement been entirely disconnected from any external organisation, and have been maintained at the sole cost of Sir John Lawes. For the continuance of the investigations after his death, Sir John has recently made the munificent endowment of 100,000*l.*, besides the famous laboratory and certain areas of land, and has nominated some of the most distinguished scientists of the day to administer the trust.

In view of all these facts, and the great national importance of the Rothamsted experiments, it is only fitting that some public recognition should be made of the invaluable services rendered to Agriculture by Sir John Lawes and his distinguished colleague, Dr. Gilbert. Any expensive gift would, of course, under the circumstances, be out of place; the great thing necessary is that the agricultural and scientific world should make, as it were, some outward and visible sign of its appreciation of the value of Sir John Lawes's half-century of investigations. The manner in which this is proposed to be done appears to me to be such as would be both appropriate to the occasion and agreeable to Sir John Lawes's feelings.

The commemoration of the Jubilee of the Rothamsted Experiments took place at the Laboratory, Harpenden, on July 29, 1893. The occasion being one of national interest, the President of the Board of Agriculture (the Right Hon. Herbert Gardner, M.P.) occupied the chair, and there was a distinguished assembly of visitors. The Chairman carried his audience with him when, referring to the published works of Sir John Lawes and Dr. Gilbert, he said :—

Those works, more than all the perishable portraits, more than all the silver plate, even more than the everlasting granite which I see opposite me,—those works are the truest memorial of what these gentlemen have done. It is with the sincerest pleasure and the profoundest respect that I tender to Sir John Lawes and Dr. Gilbert, in the names of the Agriculturists of this country, our felicitations on the Jubilee of their work, and at the same time express our most fervent prayer that they may long live to enjoy the honour and admiration of all classes of their fellow-countrymen.

The granite memorial consists of a huge monolithic boulder of irregular shape. It was obtained in Westmorland, weighs eight tons, and rests upon a granite base from the same source. It stands in front of the Laboratory at Harpenden. The

following is a representation of it, with the inscription which it bears upon a polished face :—



The Duke of Westminster, on behalf of the subscribers, presented to Sir John Lawes his portrait,<sup>1</sup> and also an illuminated address, of which the following is the text :—

TO SIR JOHN BENNET LAWES, BART., D.C.L., LL.D., F.R.S., &c., &c.

On behalf of the Committee of the Rothamsted Jubilee Fund, and of the numerous subscribers to that Fund in all parts of the world, I offer you the most hearty congratulations on the completion of half a century's uninterrupted investigation of agricultural problems of the highest practical value and interest.

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<sup>1</sup> The Portrait is a life-sized three-quarter length, by Mr. Hubert Herkomer, R.A., and represents Sir John Lawes standing in a characteristic attitude, facing the spectator. A reproduction of the head of the portrait is given as the frontispiece to this brief Memoir, and faces p. 511. At the foot of the frame is a brass plate with the following inscription :—

PRESENTED  
BY SUBSCRIPTION  
TO SIR JOHN B. LAWES, BART.,  
D.C.L., LL.D., F.R.S.,  
TO COMMEMORATE THE  
JUBILEE OF THE ROTHAMSTED EXPERIMENTS,  
JULY 29TH, 1893.

These investigations, which originated with you, relate not only to the growth of cereal and other crops under the most varying conditions, but also to the economic effect of different foods on the development of the animals of the farm. They have embraced, moreover, most important researches concerning the chemical constituents of soils, the rainfall, drainage waters, and the sources from which plants derive their supply of nitrogen.

During the whole of this period of fifty years you have had the zealous co-operation of your lifelong friend Dr. Joseph Henry Gilbert, whose name will ever be associated with yours, and whom jointly with you we desire on the present occasion to congratulate.

For the continuance of the experiments and investigations which have already extended over so long a period, you have munificently provided by the establishment of the Lawes Agricultural Trust, so that our successors will profit even more, if possible, than we of the present day have done, by your enlightened labours.

The Memorial which is now erected will, it is hoped, preserve your joint names in honoured remembrance for centuries to come, while the portrait that is presented to you herewith will hand down to future generations the likeness of one of the most disinterested as well as the most scientific of our public benefactors.

ALBERT EDWARD P.

July 29, 1893.

The Duke of Devonshire, as President of the Royal Agricultural Society in 1893, in presenting an address from the Society, remarked that they had had set before them at Rothamsted a model of what all work of experimental inquiry ought to be, and that example, and the notable results achieved by it, had stimulated the carrying out of experiments on a lesser scale on other farms. He need only allude to the foundation of the Woburn Experiments, which took their rise directly from the Rothamsted researches, and to numerous local societies which had been more or less concerned in experimental work, and to which Rothamsted had given so great an impulse. The address was as follows :—

TO SIR JOHN BENNET LAWES, BART., D.C.L., LL.D., F.R.S., &c., &c.

*Trustee of the Royal Agricultural Society of England.*

The Royal Agricultural Society of England by its Council gladly embraces the occasion of the Jubilee of the Rothamsted Experiments to tender to you its hearty congratulations upon the satisfactory completion of half a century of unceasingly applied scientific knowledge to the solution of problems affecting the cultivation of the soil, and the theory and practice of economic animal nutrition—problems of world-wide importance.

It has been well said that nothing in the records of scientific research is more honourable to our country than the experiments which, with self-denying skill, you have, in conjunction with Dr. Gilbert, carried on and continue at Rothamsted.

These independent and continuous scientific operations, conducted under uniform conditions, are unique in the whole history of science. They have been carried on during fifty years at your sole cost, and their future continuance you have secured by munificent endowment.

As regards ultimate cultivation, without added or artificial enrichment, you have taught those concerned how to estimate the actual mean fertility of the earth's surface; and amongst other innumerable and invaluable lessons, be it especially remembered that in the composition of permanent pasture you have, to the practical advantage of the farmer, successfully employed readily available chemistry to modify at pleasure the entire character of the vegetation.

Good and true work is usually abundantly prolific; and the Rothamsted example has already led, in various directions, to the formation of lesser experimental stations, and, notably, the Royal Agricultural Society owes to your immediate advice, precept, and example, much of such success as may have attended the experimental station established at Woburn.

As a member of the Council during a period of forty-five years, the Society has benefited by your active co-operation. You have frequently been applied to for special advice and assistance, and, in response, you invariably rendered services to the Society which have been simply invaluable; and, further, you have, in conjunction with Dr. Gilbert, contributed to the *Journal of the Society* a series of scientific papers, which papers alone would render the *Journal* famous.

In an age of science, a period of active evolution, Time, without doubt, will, in an ever-increasing ratio, cause your fructifying labours, and recorded experience, to be more and more realised and appreciated. The Society hopes that Providence may long spare you to continue your beneficent labours; and for all you have done for Agriculture and for the cognate sciences, and for the cultivators of the soil, the Royal Agricultural Society offers you very hearty acknowledgments and most grateful thanks.

Signed on behalf of the Council,

DEVONSHIRE, *President*.

July 26, 1893.

Addresses were presented also from the Royal Society; the Chemical Society; the Linnean Society; the Royal Agricultural College, Cirencester; the Société Nationale d'Agriculture de France; and the Association of Agricultural Experiment Stations in the German Empire. Presentations were simultaneously made to Dr. Gilbert, who very shortly afterwards received the honour of knighthood.

In his successful efforts to wrest from the soil its secrets, Sir John Lawes established facts which were unknown—undreamt of, even—in the pre-Victorian days, when he first began his experimental inquiries. Many of the truths that he discovered have now become incorporated with the stock of common knowledge, and have benefited the agricultural practice of all progressive countries. He worked, indeed, for mankind, and, happily for the results, he was actuated throughout by an unswerving purpose. The fame of the Rothamsted Station is world-wide, and visitors from beyond the seas were always impressed by the charming old Manor-house, so beautifully set among its sylvan surroundings—a fit type of the “homes of England.” They invariably carried away, moreover,—as did all who visited the station,—agreeable recollections of the goodness of heart and the courtesy of the great yet unassuming man whose remains were laid to rest, amid every sign of sorrow and respect, at the Parish Church, Harpenden, on Tuesday, September 4. Of him it might well have been written—

“Thou shalt come to thy grave in a full age, like as a shock of corn cometh in in his season.”

W. FREAM.

13 Hanover Square, W.

## Notes, Communications, and Reviews.

### THE INTERNATIONAL CONGRESS ON AGRICULTURAL EDUCATION, AT PARIS, JUNE 14-16, 1900.

As Delegate appointed by the Royal Agricultural Society of England at the March Council Meeting, I duly attended the Congrès International de l'Enseignement Agricole, which was inaugurated on June 14, at Paris, in connection with the Exhibition.

At 2 o'clock on Thursday, June 14, the French Minister of Agriculture took the Chair in the large hall of the Salles des Conférences, and formally opened the Congress with a speech in which he specially welcomed the foreign delegates. The Bureaux were then formed, Mons. Casimir-Périer being elected President, and representatives of the Austrian, German, Italian, United States, and other Governments, and myself, as representing the Royal Agricultural Society of England, were invited to support him on the platform.

Mons. Casimir-Périer delivered his inaugural address, which was particularly well received, and he was followed by M. Tisserand, formerly Directeur de l'Agriculture at the French Ministry of Agriculture, who read a Paper on "L'Enseignement Universitaire; ce qu'il devrait être au point de vue agricole."

Mons. Casimir-Périer thereupon asked me to give some account of the steps taken recently in this direction by the Oxford and Cambridge Universities, which enabled me to call attention to the intimate association of the Royal Agricultural Society with the agricultural schemes of both Universities, pointing out that at Oxford our Society is represented by the Chairman of our Education Committee, Lord Moreton, and by myself on the Joint Board of Management of Agricultural Studies, and that at Cambridge the success of the new Agricultural Department under Dr. Somerville is largely the result of the munificence of our colleague, Sir Walter Gilbey, and the efforts of Mr. Pell and Sir Ernest Clarke.

This information appeared to be of considerable interest to the three or four hundred delegates assembled from all parts of the world at the Paris Congress.

On the following day, Friday, I formally delivered the Paper on "L'Enseignement Agricole dans la Grande-Bretagne" (see Appendix), which Sir Ernest Clarke had kindly prepared for me from notes and suggestions for it which I had handed to him before leaving England. Both this statement, which was well received by the delegates, and my impromptu speech on University Education on the opening day, will appear in the Official Report of the Congress.

I had the honour to receive, as the Society's representative, an invitation to a banquet in connection with the Congress at the Hôtel Continental, presided over by M. Casimir-Périer; and the President of the Republic, M. Loubet, graciously sent to my hotel an invitation to the Elysée.

Nothing could exceed the kindness and courtesy of everyone, and at my suggestion special letters have been ordered by the Council to be addressed by the Secretary of the Society to Mons. Casimir-Périer, President, and M. de Lagorsse, the Secretary-General of the Congress, expressing the Society's appreciation of the reception accorded to its representative at the Congrès International de l'Enseignement Agricole.

MARTIN J. SUTTON.

Henley Park, Oxon: August 1, 1900.

## APPENDIX.

### *Paper read by MR. SUTTON at the Congress.*

As Delegate of the Royal Agricultural Society of England to the International Congress of Agricultural Education, I have the honour to report that that Society, which has about 11,000 Governors and Members, and which is the leading Agricultural Society in Great Britain, has taken a very important part in the direction of Agricultural Education in that country. The Society was originally founded in the year 1838, and two years later it received a Royal Charter of Incorporation, which cited that, amongst other important objects, the Society was "to take measures for the improvement of the education of those who depend upon the cultivation of the soil for their support."

Practically the whole of the work of such a Society as that which I have the honour to represent may be regarded as educational in character, and, as a matter of fact, the work which the Society accomplished in its early days had the very greatest educational value, though not exactly in the sense which, I presume, this Congress is specially summoned to discuss, viz. the mental training and equipment of the young.

The articles on Scientific and Practical Agriculture published in the Society's Journal, which has been continuously issued from 1839 to the present time—including the splendid Agricultural Monographs of Sir John Lawes and Sir Henry Gilbert, and reports on the chemical experiments at Woburn, experiments in animal

pathology, investigations into the ravages of injurious insects, parasites, and fungi, and the exhaustive scientific trials of agricultural implements—have all had their share in educating and stimulating agricultural intelligence.

Long before the State in Great Britain had recognised any obligation to do anything in the direction of Agricultural Education, and even before the passing of the Elementary Education Act of 1870—the first attempt of the State to undertake the instruction of its future citizens—the Royal Agricultural Society inaugurated schemes of Annual Examinations for Prizes and Certificates which have been of the greatest value in promoting the study of the science of Agriculture.

The organisation and conduct of these examinations have been the chief work of the Society's Education Committee, one of the most important of the numerous Standing Committees of the Council of the Society. The Committee (whose present Chairman is Lord Moreton) was appointed on April 6, 1864, for the purpose of giving more precise effect to the object of the Society's Charter, the words of which have been already quoted. Its early recommendations were the subject of great controversy, and various schemes were tried without success.

It is interesting in these days to mark the differences which divided the members in their early struggles for improved Agricultural Education. On the one hand were those who advocated the advancement of sound general education to prepare the mind of the student for the proper reception of that practical knowledge of agriculture which can only be completed by observation of the working of a farm. On the other were those who urged the special training of young men in the science and practice of agriculture during the interval between the completion of ordinary education and entry upon practical work.

Eventually two well-defined schemes were adopted, known as the Senior and Junior Examinations of the Society. The former were started in 1868, the latter in 1874. The Senior Examination, open to all candidates of whatever age or locality, has up to the present year been held annually in May, and comprised the following subjects: Practical Agriculture, Chemistry, Book-keeping, Land Surveying, Agricultural Engineering, Geology, Botany, Veterinary Science, and Agricultural Entomology. Out of a total of 532 candidates who have entered for these examinations from 1868 to 1899, 190 gained first-class, and 82 gained second-class certificates.

The certificates granted by the Society have long possessed a high value in connection with agricultural appointments both at home and abroad, being, in fact, the nearest approach to a national agricultural diploma obtainable in England. During recent years, when Agricultural Education has received a remarkable impetus throughout the country, their possession has proved especially useful.

The Highland and Agricultural Society of Scotland, which performs for the northern part of Great Britain similar functions to

those of the Royal Agricultural Society, and which had for a number of years organised a similar examination of its own, joined forces in 1899 with the Royal Agricultural Society for the establishment of a joint examination for "The National Diploma in the Science and Practice of Agriculture" for Great Britain, to take the place of the two separate examinations heretofore conducted by the two Societies separately.

Accordingly a National Agricultural Examination Board, consisting of representatives of both Societies, was constituted, and I had the honour of being appointed one of the English members of the Board. The Regulations and Syllabus of the Examination for the National Diploma in the Science and Practice of Agriculture, as finally settled by the Board on October 20, 1899, are annexed hereto as showing the scope and character of the examination.<sup>1</sup>

It was considered desirable by the Board that, with a view of securing thoroughness in the study of the several subjects included in the Syllabus by the candidates for the Diploma, the examination should be spread over two years and be taken in two divisions: Division I. (first year) comprising the subjects of Mensuration and Land Surveying, Agricultural Botany, General Chemistry, Geology, and Agricultural Entomology; and Division II. (second year), the subjects of Practical Agriculture, Agricultural Book-keeping, Agricultural Chemistry, Agricultural Engineering, and Veterinary Science.

The first examination for this new Diploma was held in May last, at the Yorkshire College, Leeds. By the final date fixed for the receipt of applications to sit at the examination (March 31), 53 candidates had entered, of whom 14 were successful.

The Junior Examinations were instituted in 1874, when a scheme prepared by the Education Committee was adopted, with the object of encouraging the preliminary study of Agriculture in middle-class schools. By this scheme 10 scholarships of 20*l.* each were annually competed for, from the years 1874 to 1895. The subjects of examination comprised the Principles of Agriculture, Agricultural Chemistry, Elementary Mechanics as applied to Agriculture, and Land Surveying. The average annual number of competitors for these scholarships was about 36, and the average annual number of competing schools about 12. Altogether 296 candidates passed the examination, of whom 196 gained scholarships of an aggregate money value of 3,920*l.*, and 100 certificates. The funds recently placed at the disposal of the County Councils, which have been largely devoted to the improvement of technical agricultural education by the establishment of scholarships and other incentives, rendered the continuance of the Society's junior scholarships unnecessary, and it was therefore decided at the end of the year 1895 to withdraw them.

The funds thus released were devoted by the Council to a new

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<sup>1</sup> Not here reproduced. The Regulations and Syllabus will be found on pp. 363-9 of Part II. of this volume.—ED.

scheme to meet a pressing want for the more systematic examination of teachers and students of dairying. Considerable efforts have been made during the last few years to improve the methods of English dairying. Numerous teaching institutions, old or new, have taken up the subject, and in consequence there has been a steady demand for capable and practical dairy teachers. Most of the institutions have granted diplomas to their successful students, which, of course, have had a certain local value. There was, however, no national independent standard or test of the value of the teaching given, and the lack of uniformity was only too painfully evident. At first it was hoped that the Board of Agriculture, which dispenses Government grants to most of the institutions imparting dairy instruction, would take the steps necessary to remedy a recognised defect. But the powers granted to the Board by Parliament proved insufficient for this purpose. Then an endeavour was made to ascertain whether a National Board for the granting of diplomas could be formed of representatives selected from the various bodies interested in dairying, and the Board of Agriculture summoned a conference, which met in October 1895, to consider the question. At this conference so many divergent views were expressed by the delegates that the evolution of a scheme which would meet with general acceptance appeared hopeless, and the realisation of the object in view as far off as ever.

It was then that the Council of the Royal Agricultural Society determined to put forth a plan of its own, and hold an Examination in the Science and Practice of Dairying which should have general support as emanating from the National Agricultural Society, and whose diploma should have the weight which a perfectly independent test alone could give. The syllabus of this Examination, which is included in the Appendix,<sup>1</sup> exemplifies the Society's motto, "Practice with Science," for successful candidates must not only be able to milk a cow, but must prove themselves conversant with scientific facts respecting the bacteriology of milk, cream, butter, and cheese.

This examination for the Diploma in Dairying is now, like the examination in Agriculture, conducted under the joint auspices of the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland by the National Agricultural Examination Board before mentioned.

Altogether, since these Dairy Examinations were started in 1896, 103 candidates of both sexes have been examined, and 62 of them have gained the National Diploma.

In 1890 the Society's Education Committee endeavoured to meet an acknowledged want on the part of Agricultural teachers and students, by undertaking the publication of a Text-Book on Agriculture. They entrusted the writing of the work to Dr. Freame, and the proofs were submitted to and carefully revised

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<sup>1</sup> Not here reproduced.—ED.

by some of the leading authorities of the day in the various departments of the subject, whilst no pains and expense were spared in providing suitable illustrations.

The result was the production of a work entitled "*Elements of Agriculture*," which may fairly be described as an Agricultural classic. Published at the popular price of 3s. 6d., it has already run through six editions, and has been translated into at least one foreign language.

Having now indicated the educational work with which the Royal Agricultural Society has been particularly identified, it may be well to pass briefly in review the progress of Agricultural Education in Great Britain during the past decade, i.e. since the last great Universal Exhibition at Paris in 1889. This period has in fact witnessed a striking educational movement in Great Britain, more especially in the direction of technical instruction in Agriculture. Previously to the year 1890, very little indeed had been done by the State for Agricultural Education. In 1888 an annual Government grant of 5,000*l.* was first made in aid of Agricultural and Dairy Schools in Great Britain. In 1889 the Board of Agriculture was established by Act of Parliament, and amongst other duties was entrusted with the administration of this grant, which has now increased to 7,350*l.*, an amount that was distributed by the Board during the financial year of 1898-9 for Agricultural Education and experimental research, in varying proportions, amongst twelve different Agricultural Colleges and Institutions.

In 1890, what was practically a revolution was effected by the Local Taxation (Customs and Excise) Act of 1890, which distributed certain funds amongst the County Councils (which had then been in existence only two years), with the recommendation that those funds should be devoted to the promotion of technical instruction. No attempt was made by Parliament to guide the County Councils in their administration of the money thus placed at their disposal. Consequently, the earlier attempts to administer the funds were not very successful; but with experience and perseverance much has since been achieved, and Agricultural Education has greatly benefited, although doubtless much yet remains to be done in perfecting the system of organisation and securing a better correlation of effort between the various Councils.

Of the sums now annually administered by the County Councils it is estimated that something like 85,000*l.* is devoted to Agricultural Education in Great Britain, an amount which, as will be seen, is still far below that annually expended by our Continental neighbours and by the United States. The funds referred to have resulted in the establishment of new Agricultural Colleges in all parts of the kingdom, in special courses of Lectures and Demonstrations in Dairy Work, Poultry Keeping, Fruit Growing, Bee Keeping, &c., as well as the provision of numerous scholarships in rural schools attended by the sons of farmers and agriculturists generally.

A further step towards the more systematic organisation of

general education in Great Britain has recently been taken by an Act of 1899, which provides for the reorganisation of the Government Education Department under the title of the Board of Education. This Board has scarcely yet had time to effect any appreciable reforms; but it is to be hoped that it will in future exercise no small influence in further improving the education of the agricultural classes. Indeed, in one direction, viz. elementary education in the rural districts, valuable steps have already been taken.

Hitherto agriculturists have had great reason to complain of the want of elasticity and adaptability to rural needs of the elementary education given to children in the country. There has been far too great an adherence to one cast-iron pattern, which has, in effect, resulted in the system of education purely adapted for town life being applied to the rural communities. The natural tendency of such a state of things has been to still further accelerate the depopulation of rural districts. The creation of the Board of Education seemed to afford an opportunity of remedying this educational evil, and the Council of the Royal Agricultural Society unanimously adopted, at my instance, on March 7, 1900, a resolution to the effect that education in rural districts should be adapted to the requirements of country life. Other agricultural societies passed similar resolutions, and the result was the issue by the new Board of a circular-letter to school managers which meets the views put forward by the Society.

At the instance of the representatives of Agriculture in Parliament, advantage was taken last year to secure the insertion, in an Act known as "Robson's Act," of a provision by which School Local Authorities may under certain conditions limit the number of attendances required by children in rural districts to 250 in one year, thus providing for a kind of "half-time" system, which may lead to beneficial results in attaching the labouring classes to the land whilst young. It is yet too soon to say what advantage will be taken of this Act or to forecast with any certainty the influence which it may exercise.

It is satisfactory, moreover, to report that our ancient Universities, where the British landowners of the future are being educated, are now recognising Agricultural Science as a subject qualifying for graduation; so that there is hope that in the future all classes of the agricultural community—landowners, farmers, and labourers—may be better equipped than before in their knowledge of the principles underlying the successful practice of what is still the great national industry of the United Kingdom.

MARTIN J. SUTTON.

June 1900.

## THE SUMMER OF 1900.

THE variability of the English climate has seldom been seen in a greater degree than in the summer which has just passed away. For nearly three weeks in July the weather was extremely fine and warm, and in most places very dry. About the middle of August there was another week of genuine summer weather, not so hot as in July, but exceedingly fine and sunny. With these two exceptions the atmosphere seemed to be in a constant state of unrest, the most striking feature being, perhaps, the unusual prevalence of thunderstorms, accompanied in many instances by tremendous falls of rain and hail. The worst weather of all occurred during the opening days of August, when the country was visited by heavy and continuous rains, and by westerly gales of considerable severity for the time of year. The high winds did a large amount of damage in the orchards and hop gardens, and in many instances were sufficiently strong to tear off large branches from the trees—quite a rare occurrence in the summer time.

In June there was very little weather that seemed at all worthy of the month. Temperature was, it is true, mostly above the average; but, with cyclonic disturbances advancing over us constantly from the westward, the conditions when not actually rainy were thoroughly unsettled, with frequent showers in most districts. In the course of the whole month there was scarcely a day on which thunderstorms did not occur in some part of the country, and on the 11th there was very heavy rain in the Midlands. Towards the close of the month the thermometer fell, and until the end of the first week in July the weather was not only showery but extremely cool, the lowest temperatures being reported quite at the close of the inclement spell, when the wind blew from north-west and north.

Up to this time the agricultural prospects were by no means bright, the crops being generally in a very backward state, with every prospect of a late harvest. A radical change in the atmospheric conditions now set in, however, and for nearly three weeks the country enjoyed a spell of hot, dry, forcing weather, the day temperatures rising often above 85°, and soaring not infrequently into the nineties. With this altered state of affairs the crops soon made up the time they had lost in the earlier part of the summer, the grain ripening with an unnatural degree of rapidity, that proved not only surprising but also a little disconcerting to the farmer. Even during this run of summer heat the weather was not quite settled, many portions of the country being visited by thunderstorms of considerable violence. The worst instance of the kind occurred on July 12, when the West Riding of Yorkshire experienced a storm of tropical severity. On Rombald's Moor, lying between Ilkley and Bingley, a veritable cloud-burst occurred on the afternoon of this day, the rainfall being sufficiently heavy to tear up

the roads and to sweep away bridges, walls, and small farm-buildings.<sup>1</sup> On July 20 Northampton and the neighbouring districts were almost equally unfortunate, a terrific hailstorm doing much damage, not only to the crops, but also to glass-houses and other fragile structures.

At the end of July the weather broke up completely, and in the early days of August the country was visited by three serious cyclonic disturbances, each of which occasioned heavy rain, especially in the western and northern districts, and gales of exceptional severity for the time of year. About the middle of August there was, as we have already noticed, a decided improvement; but this did not last many days, the latter part of the month being again very changeable, with frequent rain and a renewal of the thundery weather for which the summer had been all along so remarkable.

The leading features in the weather of the entire season are shown in a statistical form on p. 535, the following remarks giving further details of interest in the history of each particular element.

*Temperature* was, as a rule, above the average, the only weeks with any general deficiency of warmth being the last in June, the first in July, and the second in August. During the latter part of August the temperature differed but little from the normal. The warmest weeks were the second in June and the third and fourth in July. Taking the season as a whole, the mean temperature was consequently above the average, the difference being comparatively small in the north-western district, but large in the midlands, and still larger in the eastern counties. As a rule the excess of warmth was greater in the night than in the day-time, this being especially the case in the eastern district. In the south-western parts of the country, however, the state of things was reversed, the night temperatures being very little above the normal. A comparison with previous summers shows that in nearly all districts the season was not nearly so warm as that of 1899, and that in the south and south-west it was not so warm as in 1897. With these exceptions it was the warmest summer experienced since that of 1893. The highest temperatures of the season were recorded mostly between July 16 and 20, when the thermometer in the shade rose to between 85° and 90° in nearly all parts of the country, to 92° in London, and to 95° at Cambridge. In the eastern, midland, and southern counties, however, the heat was nearly as great on July 25, the thermometer again exceeding 85° in many places, and reaching 91° in London and 92° at Cambridge. Other spells of hot weather occurred respectively on June 11 and 12, and between August 13 and 18; but in these cases the warmth was short and spasmodic. Over the country as a whole the absolute maximum temperature of the summer differed but little from those registered in many recent years. In London, however, the reading of 92° on July 16 and 19

<sup>1</sup> This and many other details relating to the heavy rainfalls of the season are from *Symons' Meteorological Magazine*.

was the highest recorded since August 1893, when the thermometer rose to  $93^{\circ}$ ; while at Cambridge the reading of  $95^{\circ}$  on July 20 was the highest recorded since August, 1876, when a similar temperature was observed. The lowest temperatures of the summer were experienced mostly in the first week of June, when the sheltered thermometer fell below  $45^{\circ}$  in many parts of the country, and below  $40^{\circ}$  at some of the northern and inland stations, the lowest reading reported being one of  $36^{\circ}$  at Durham. In many places, however, the nights were almost as cold about July 8 or 9, when readings a trifle below  $40^{\circ}$  were registered at some places in the west; at Hereford the thermometer fell to  $39^{\circ}$ , and at Llandovery (Carmarthenshire) to  $36^{\circ}$ . In another cold spell, occurring about the middle of August, the thermometer fell to  $39^{\circ}$  at Llandovery, and to  $36^{\circ}$  at Alnwick Castle. A comparison with previous years shows that the low summer temperatures we have quoted were by no means exceptional. Even last year, when the season was upon the whole so exceedingly warm, the thermometer on June 14 fell lower than at any time during the recent summer, a slight ground frost being reported in many parts of the country.

*Rainfall.*—The rainfall was in excess of the average throughout the greater part of June, and also at the beginning of August, and in the third week of that month; the fall over the country generally being heaviest between August 2 and 6. During the greater part of July there was a general deficiency of rain, a similar state of things existing about the middle of August, and quite at the close of the season. Taking the summer as a whole it appears that in the southern counties there was a rather large deficiency of rain, and in the Channel Islands a still larger deficiency. In the eastern, and also in the south-western districts, the total amount differed but little from the normal; but in the northern parts of the country there was a considerable excess, amounting to as much as 37 per cent. in the north-eastern, and to 17 per cent. in the north-western counties. In nearly all districts the summer proved the wettest of recent years, the fall in the eastern and southern counties being greater than in any year since 1895. At Yarmouth it was the wettest summer since that of 1892, and at Loughborough and Liverpool since that of 1891; while at Shields, where the total rainfall amounted to more than half as much again as the average, it was the wettest since at least the year 1866, when the record at that place commenced. Valuable evidence as to the character of last summer's rains is afforded by the statistics relating to the number of days on which the falls occurred. From these figures we see that in most districts the number of days with rain agreed very closely with the average, and that in the two wettest districts, viz. the north-eastern and the north-western, the agreement was absolute. It is clear, therefore, that the wetness of the summer was not attributable to any undue frequency of rain, but to the weight of the falls that actually occurred, many of the heaviest being associated with thunderstorms of greater or less severity. To enumerate anything like the number of individual instances on

**Temperature, Rainfall, and Bright Sunshine experienced over England and Wales during the Thirteen Weeks ended Sept. 1, 1900.**

(The Summer Season.)

Districts	TEMPERATURE							
	High- est ob- serv- ed	Low- est ob- serv- ed	Day temperatures		Night temperatures		Day and night temperatures combined	
			Mean	Differ- ence from average	Mean	Differ- ence from average	Mean	Differ- ence from average
North-eastern counties . . .	84	36	65·7	+1·3	52·1	+1·1	58·9	+1·2
Eastern counties . . .	95	42	69·8	+1·6	53·5	+2·4	61·7	+2·0
Midland „ . . .	90	39	69·6	+1·4	51·9	+1·7	60·8	+1·6
Southern „ . . .	92	40	69·2	+1·0	54·3	+1·3	61·8	+1·2
North-western counties, in- cluding North Wales . }	83	38	65·8	+0·7	53·0	+1·0	59·4	+0·8
South-western counties, in- cluding South Wales . }	89	36	67·4	+2·0	52·8	+0·3	60·1	+1·1
Channel Islands . . .	87	46	67·1	+1·6	56·7	+1·2	61·9	+1·4

Districts	RAINFALL				BRIGHT SUNSHINE			
	Days with rain		Total fall		Duration		Percentage of possible amount	
	Num- ber	Differ- ence from average	Am- ount	Proportion of average amount	Hours re- cord- ed	Differ- ence from average	Per- cent- age	Differ- ence from average per- centage
North-eastern counties . . .	44	0	ins.	per cent.	461	+ 3	32	+1
Eastern counties . . .	43	0	9·7	137	677	+ 78	48	+6
Midland „ . . .	41	-2	8·0	103	572	+ 77	40	+5
Southern „ . . .	38	-3	6·2	90	708	+113	51	+9
North-western counties, including North Wales }	47	0	10·5	117	561	+ 31	39	+2
South-western counties, including South Wales }	48	+1	9·3	99	645	+ 37	46	+3
Channel Islands . . .	48	+2	5·3	79	743	+ 74	54	+6

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office. The averages employed are: For Temperature, the records made during the twenty-five years, 1871-95; for Rainy Days, the values for the fifteen years, 1881-95; for Total Rainfall, those for the thirty years, 1866-95; and for Bright Sunshine, those for the fifteen years, 1881-95.

which these semi-tropical drenchings came down would entail too great an expenditure of space; it must suffice, therefore, to quote some of the principal cases reported. On June 11 the midlands and northern counties were visited by a very heavy fall, amounting to 1·3 inch at Skipton, and to 2·0 inches at Breadsall Priory, near Derby. On June 24 the northern counties were again affected, as much as 1·8 inch of rain falling at Alnwick Castle, and 1·5 inch at Newcastle-on-Tyne. The next case occurred in the same district, on July 12, and was especially severe, as we have already seen, in West Yorks; at Heaton 3·3 inches fell, and at Gilstead 4·5 inches, while at one station, at Ilkley, there was as much as 5·4 inches—the bulk of these very large amounts occurring in the space of an hour or two. On July 20 the eastern and midland counties were visited, a fall of 1·7 inch occurring at East Dereham, and 2·3 inches at Breadsall Priory. The remaining cases of any great note occurred respectively on August 2 and August 6, when the whole of the northern districts experienced very heavy falls. On the 3rd 2·6 inches was recorded at Scarborough, and 2·4 inches at Shields; while, on the 6th 1·9 inch fell at Llandudno, 1·8 inch at Alnwick Castle, and 1·6 inch at Manchester.

*Bright Sunshine.*—Notwithstanding the generally unsettled state of the weather, the duration of bright sunshine was usually in excess of the average. Throughout the whole of June and July, and, in fact, up to the beginning of August, there was only one week in which a deficiency was reported over the whole country, the second and third weeks in July being especially fine. In August the duration was as a rule less than the normal, an important exception occurring, however, during the week ending the 18th, which proved one of the sunniest of the whole summer. Taking the season in its entirety, we find that the total amount of sunshine was in excess of the average in all districts, the excess being, however, very insignificant in the north-eastern counties. In the two western districts it was also rather small; but in the eastern, midland, and southern parts of the country the amount was considerably above the average, the sun shining in the southern counties, and in the Channel Islands, for more than half the time he was above the horizon. Satisfactory as they are, the figures for the summer compare, however, very unfavourably with those recorded in the glorious season of 1899. Even in the two districts last mentioned the total duration was more than 200 hours less than it was last year, while, in the south-western counties, there was a falling off amounting to over 250 hours. With the exception of 1899 the summer in the eastern and southern districts was the sunniest experienced for at least seven years past. In the midlands and the north-west it was not so fine as in 1897, while in the north-east and the south-west it was the cloudiest since 1894, the difference between this and previous years being, however, in some cases very slight.

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IMPORTED DAIRY PRODUCE.<sup>1</sup>

## BUTTER.

THE Australasian butter season of 1899-1900 established two records, both highly complimentary to the energy and enterprise of the Australasian dairy farmers, and particularly satisfactory after four disastrous seasons of drought. The first is that in the eight months ended April 30, 1900, nearly 25,000 tons of Australasian butter entered the United Kingdom, this exceeding the previous highest yearly import by 10,200 tons. The second is that the increase of the season over its immediate predecessor was the enormous amount of 11,000 tons, which is nearly double the increase in a single year that any country in the world ever made. The greatest increase that even Denmark, whose progress has been phenomenal, succeeded in making was 6,467 tons in 1898 over 1897, but that was in twelve months, while the Australasian increase was the result of only eight months' imports.

The season exhibited two other interesting but less noteworthy features. It began earlier and continued later than any season before, and from the first week in October to the very end of April, with only nominal exceptions, values pursued a slow but steady decline. In the beginning of October the "Choicest" brands of Australasian butter brought 126s. per cwt., and at the end of April they sold for 94s., or a decline of 32s. from the highest figure.

An examination of the imports of the season from the various Colonies of Australasia shows, as might be expected, that Victoria heads the list both in total amount and largeness of increase over the previous season, the import for the eight months from that Colony being 12,635 tons, or an increase of 5,367 tons over the previous season. New Zealand comes next, with a total import of 7,465 tons, or an increase of 3,398 tons. The third place is taken by New South Wales, with a total import of 3,820 tons, or an increase of 1,735 tons. South Australia's total is only 386 tons, and the increase 220 tons; while Queensland's total import shows 365 tons and the increase 228 tons, although in the case of this Colony a considerable quantity of its butter is transhipped at Sydney, and is entered in the Customs Returns as belonging to New South Wales. Thus there is a most satisfactory increase all along the line. Summing up these figures, it is seen that the total import for the season from Australia is 17,207 tons, and the increase over the previous season 7,550 tons; while the total from New Zealand is 7,465 and the increase 3,398 tons. Table I., showing the imports of Colonial butter into the United Kingdom for the last six seasons, from September to April inclusive, supplies further details of the progress made in catering for British markets.

<sup>1</sup> From Messrs. W. Weddel & Co.'s *Australasian Dairy Produce Review* (Season 1899-1900),

TABLE I.—Imports of Colonial Butter during the Australasian Butter Season

Season	Victoria	N.S. Wales	S. Australia	Queensland	Total Australian	New Zealand	Canada	Grand Total
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
1894-95	205,308	26,338	11,633	—	243,279	46,093	17,979	307,351
1895-96	143,651	1,058	6,984	—	151,693	51,166	31,067	233,926
1896-97	140,701	82,816	1,393	1,278	175,683	61,763	66,810	304,256
1897-98	106,745	44,685	163	5,757	157,350	73,607	85,050	316,007
1898-99	145,358	41,703	3,312	2,749	193,122	81,332	121,989	396,443
1899-00	252,703	76,410	7,722	7,306	344,141	149,290	146,444	639,875

It will be noticed in this table that Canada, which belongs to quite another group of British Colonies, and is situated in an altogether different part of the world from Australasia, is also very satisfactorily increasing its export of Colonial butter to the United Kingdom. Like New Zealand, this Colony exhibits, season by season, a steady increase, without that periodical retrogression which unfortunately has been one of the characteristics of the dairy industry in every Colony of Australia. The total import from Canada during the Australasian season (not for the year) was 7,322 tons, which was an increase over the previous season of only 723 tons. It is, however, scarcely fair to compare the growth of Canadian imports merely for the period of the eight months which constitute the Australasian season. If we take the Canadian imports for the year ended June 30 and compare them from year to year, the total and the growth are both much more favourable to Canada. For instance, during the year ended June 30, 1900, the total import from Canada was 11,932 tons, and the increase over the previous year 3,781 tons.

*Prices.*—During the season 1898-1899 there was a closer drawing together of the prices of "Choicest" and "Finest" qualities of butter than in any previous period, and this same characteristic was maintained during the season 1899-1900. This peculiar position of the market values of these two grades does not coincide with their intrinsic qualities, for while the market valuation differs by not more than 4s. per cwt., the intrinsic difference is at least 10s. per cwt. The "Choicest" grade undoubtedly is worth more money than it realises, but the assertion of agents for several years, that Australasian butter is specially suited for retailing at a shilling, has created a belief among buyers that a shilling is the proper retail figure for it. The "Choicest" grade, however, should be exempt from this prejudice, and if there were any properly organised butter committee to regulate the sale of Australasian butter in British markets, as there is of all other classes of butter, then "Choicest" brands should fetch a halfpenny to a penny per lb. more than they do now.

The average price for the season 1899-1900 works out at the

same figure as for the previous season, but this is due to the extraordinarily high prices which prevailed during the two months September and October, when only comparatively small quantities of butter were on the market. The average for the other six months, when the bulk of the Australasian butter arrived, was 3s. per cwt. below the previous season. The most important point regarding the prices of Australasian butter during the season 1899-1900 was its decreased value relatively to Danish butter, compared with that of previous seasons. How important this question is can be seen from Table II., which gives the top prices for "Choicest" quality of Australasian and Danish butter for the last six seasons.

TABLE II.—Average Top Prices of Choicest Australasian and Danish Butter in London.

Season	Australasian		Danish		Difference	
	per cwt.		per cwt.		per cwt.	
	s.	d.	s.	d.	s.	d.
1894-95	101	6	109	1	7	7
1895-96	108	5	113	9	5	4
1896-97	104	4	114	9	10	5
1897-98	100	4	110	7	10	3
1898-99	103	6	113	6	10	0
1899-00	103	4	116	7	13	3

Table III. has been constructed to show how the value of Australasian butter has this season depreciated in comparison with Danish since the previous season.

TABLE III.—Difference per cwt. between the Prices of Australasian and Danish Butter.

Season	Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		April		Average for season	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1898-99	—	6	2	8	6	12	0	10	6	11	6	14	6	7	2		10	9
1899-1900	10	0	10	0	11	6	17	5	14	4	10	0	10	0	11	6	13	3

It is thus seen that Australasian lost ground as compared with Danish in five out of the seven months (where a comparison can be made) to the extent of 4s. 1d. per cwt., while it gained in two of the months to the extent of 3s. only. In some months the difference was very great, notably in January, when it was 17s. 5d., while for the four months October, November, December, January, when three-fourths of the Australasian butter arrived, the average difference was 13s. 3d. per cwt. During the same four months in the previous season the average difference was only 9s. 3d. Another view of this serious aspect of the relative prices of Australasian and Danish butter in British markets is shown by the difference in the two kinds for the last six seasons as given in Table II.

Among agents, various reasons are advanced to explain these facts, the principal being that Australasian butter is not so good as it was, while Danish is getting better. Anyone well acquainted, however, with both butters, knows this is not so. Australasian butter gets better every year, and is now so close in its intrinsic merits to Danish that very large quantities of it are retailed at the same price. That some of the Australian brands suffered from fishiness this season and that this particular flavour much reduced the value of those brands is true, but the figures quoted above include the top quotations of all of the "Choicest" brands, and therefore the falling off in quality of an odd brand here and there does not affect the question of comparative top value to Danish. In New Zealand butter, for example, fishiness is almost unknown, and it is recognised by everybody that New Zealand butter has improved year by year, until it is pressing Danish very hard in the matter of quality, yet the figures quoted above include New Zealand. The principal reason, however, for the temporary increased disparity in prices during the season 1899-1900 was the diminished supply of Danish, and the greatly increased quantity of Australasian butter on the market.

*Margarine Mixtures.*—The "Sale of Food and Drugs Act," which came into operation on January 1, 1900, and which restricts the amount of butter in Margarine Mixtures to a maximum of 10 per cent., has had a very beneficial effect in largely stopping the palming off upon consumers high-class Margarine Mixtures in place of pure butter. The universal testimony of sellers of these high-class mixtures is that they are not doing so much business in this class of goods as before the Act came into operation. By limiting the amount of butter to 10 per cent. the consumers have been able to detect the pooriness of quality in the mixtures, and many people have rejected them in favour of pure butter, and in future the competition will be mostly between pure margarine and pure butter. This is as it should be. The high prices of butter which have ruled this spring, and which for many years have been almost unknown at that time, are much more largely attributable to the removal of the competition of high-class Margarine Mixtures with butter than is generally understood. After Easter, instead of the prices of butter falling away, as has been the experience of recent years, they actually advanced all through May and June, a fact which cannot reasonably be accounted for merely by the coldness and lateness of the spring or by the short supply of imported butter, but is easily explainable by the removal of Margarine Mixtures from the position of powerful competitors with pure butter.

*Arrivals of Butter.*—There has on the whole been more regularity both as regards time and quantity in the arrivals of Australian and New Zealand butter than in any previous season. Sometimes the Australian and New Zealand vessels have arrived too close together, and if this could be avoided in future there would be very little further improvement to be suggested. The war in South Africa somewhat disorganised shipping arrangements during the season.

The astonishing progress which Colonial butter is making in British markets is shown by the fact that for the last five years ended June 30, the import has grown from 12,949 tons to 37,534 tons per annum, or an increase of 24,585 tons in the five years. During the same period the import of foreign butter has actually decreased by 42 tons. It is during the mid-winter months that the Colonial butter from Australasia arrives on our markets, while that from Canada begins to arrive in July, and virtually ceases in the following January. The bulk of the Canadian reaches British markets during August, September, and October; the bulk of the Australasian in December, January, and February. If a comparison of progress be made between the imports of Colonial and Foreign butter for the six winter months, October to March, during the past five years, it shows that Colonial increased by 14,592 tons, while foreign showed an actual decrease of 6,167 tons. Of the increase of 14,592 tons of Colonial butter, 10,566 tons came from Australasia, and the remaining 4,026 from Canada.

#### IMPORTS OF BUTTER AND CHEESE.

*Season v. Year.*—As the Australasian and Canadian butter seasons occupy the end of one calendar year and the beginning of the next, the official statistics of the United Kingdom divide the season into two separate returns. Hence, in comparison with countries where statistics are given in calendar years, it is difficult to realise accurately the progress which the Australasian and Canadian colonies are making in British markets. In this Review the year for all countries is taken as ending on June 30, which enables a much more satisfactory comparison to be made, and exhibits the progress or decline of the imports from foreign countries, or from the Colonies which contribute dairy produce to our markets. The home production is also estimated for the year ending June 30.

*Butter.*—The remarkable way in which the imports of butter have regularly increased for many years is again exemplified by the year which closed on June 30 last. It appears to be demonstrated by the experience of the past decade that the United Kingdom is quite unable to produce sufficient dairy produce to supply its own population. In the year ended June 1891, the total import of butter was 102,500 tons, and for the year ended June 1900, it was 170,700 tons, which shows an annual average increase in the decade of 6,800 tons. This growth has been on the whole very uniform, any disturbance in its uniformity being more attributable to the deficient seasons in our colonies and foreign countries than to the bountiful seasons at home. Twice in the decade has the import of butter from Colonial sources fallen off slightly from the previous year, viz., in 1896 and 1898, while only once has there been any decrease in the foreign supply, and this occurred during the present year. In 1896 the Colonial supply fell off by 5,000 tons, principally owing to drought in Australia, but from foreign countries this deficiency was more than wiped out as the increased import from these

sources exceeded 16,500 tons. In the present year the position has been reversed, for while the foreign import fell away to the extent of 9,000 tons the supply from the colonies exceeded that of last year by 15,000 tons, thus leaving a gain in the quantity of imported butter of 6,000 tons on the year. Distinguishing, as in Table IV., the two sources of supply for the past ten years, the import of Colonial butter has been augmented by 34,600 tons, and that of foreign by 33,600 tons, so that the increased import for the period is fairly divided between Colonial and foreign sources. If, however, the last five years be taken it will be seen that the growth of Colonial butter has far exceeded that from foreign countries. During this quinquennial period the annual import of Colonial butter has increased by 24,500 tons, while that of foreign has virtually made no progress whatever. It is but fair, however, to note that the effect of an abnormal increase in Colonial and an unusual deficiency in foreign for the past year modifies to a great extent this position. Still, on the whole, the progress in the import of Colonial butter far exceeds that made by foreign.

If we examine in detail these two classes of imports, it will be seen that the Australasian Colonies have increased their quota since 1891 by 13,400 tons, and Canada by 11,100 tons. Turning to foreign countries, Denmark, as was to be expected, shows the greatest development in the supply of imported butter, which has increased in the past ten years by 28,678 tons. Next come Russia and Holland with increases respectively of 7,207 tons and 6,589 tons. Sweden, which made a steady progress from 1891 to 1896, has since then declined, and this year sent 1,400 tons less than ten years ago. France and Germany are rapidly falling away, and the latter country will soon cease its supply altogether. Five years since it was 6,000 tons annually, this year it was 1,850 tons. France, which in 1891 sent 26,000 tons, has regularly declined, and this year sent only 16,800. Among the countries sending smaller quantities, Argentina, Belgium, and Norway are all gradually increasing their supplies, but their totals are comparatively small, as they together contribute only 6,400 tons out of a total foreign supply of 133,000 tons. The United States has been erratic in its supplies during the decade, and up to now has not made butter specially for export to the United Kingdom as all the other foreign countries have done. Consequently it is only when supplies from elsewhere fail that American butter is sought for by British buyers. The large amount of salt in American butter, although suitable for the American palate, prevents it ever becoming popular in the United Kingdom.

*Cheese.*—There is no such increase to be reported in the import of cheese as in that of butter. Cheese is year by year becoming less an article of general consumption, owing, undoubtedly, to the growing prosperity of the working classes, who formerly largely relied upon this commodity in their dietary, but are now able to purchase more butcher's meat instead. During the decade the import of cheese has grown by only 24,500 tons, while that of butter

TABLE IV.—Estimated Home Production and Imports of Butter into the United Kingdom for the Ten Years ended June 30, 1900.

Year ended June 30	COLONIAL					FOREIGN										Grand total		
	Horns estimated	Australia	Canada	New Zealand	Total Colonial	Argentina	Belgium	Denmark	France	Germany	Holland	Norway	Russia	Sweden	United States America		Other countries	Total Foreign
1891	84,961	874	792	1,217	2,883	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1892	86,022	2,373	2,295	1,555	6,393	—	2,176	43,080	26,087	5,908	7,765	301	381	11,838	2,631	183	99,898	187,412
1893	84,078	4,600	2,946	1,883	9,408	—	1,976	41,740	29,098	5,968	7,014	434	1,024	11,849	2,086	104	101,796	194,141
1894	78,196	10,003	2,197	2,331	15,560	—	1,517	45,806	26,548	7,770	7,136	1,014	2,172	12,858	1,639	177	106,713	199,198
1895	82,168	13,808	1,031	2,878	17,807	7	2,301	50,480	32,679	7,391	7,283	769	3,036	12,924	2,085	186	107,584	202,280
1896	83,640	8,280	2,100	2,698	13,949	689	1,981	56,567	32,401	6,039	9,169	774	5,494	14,366	4,99	170	116,780	216,706
1897	79,754	9,978	4,557	2,576	18,111	541	1,795	61,836	22,343	6,081	10,342	689	7,110	16,288	5,032	106	132,249	229,838
1898	83,059	7,837	6,963	3,933	17,732	867	1,649	63,466	22,543	3,203	13,430	1,331	9,078	15,120	8,619	120	136,800	236,645
1899	87,326	9,764	8,151	4,538	22,443	950	1,869	69,051	22,552	2,131	13,524	1,332	9,358	15,844	5,773	126	141,426	242,197
1899	83,760	17,653	11,932	7,949	37,534	1,381	2,321	74,977	19,301	1,963	13,741	1,571	7,704	18,785	5,783	97	142,193	261,963
1900							3,754	71,708	16,677	1,860	14,354	1,321	7,588	10,430	4,379	645	133,957	255,251

TABLE V.—Estimated Home Production and Imports of Cheese into the United Kingdom for the Ten Years ended June 30, 1900.

Year ended June 30	COLONIAL			FOREIGN										Grand total				
	Horns estimated	Australia	Canada	New Zealand	Total Colonial	Argentina	Belgium	Denmark	France	Germany	Holland	Norway	Russia	Sweden	United States America	Other countries	Total Foreign	
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1891	147,078	—	41,376	1,853	43,228	—	968	—	2,121	—	15,289	—	—	—	42,194	264	60,816	261,122
1892	148,624	—	44,371	1,410	45,781	—	1,275	—	2,234	—	14,532	—	—	—	41,134	277	59,453	263,867
1893	140,394	3	53,643	1,903	55,549	—	969	—	2,690	—	12,863	—	—	—	38,976	279	56,767	252,710
1894	131,843	301	55,119	1,903	57,323	—	1,361	—	2,744	—	13,845	—	—	—	34,103	525	52,386	241,663
1895	150,611	81	56,749	3,912	61,652	—	1,369	—	2,785	—	15,498	—	—	—	33,731	268	52,670	264,808
1896	137,148	81	59,423	2,974	62,478	—	1,431	—	2,682	—	14,431	—	—	—	35,744	331	44,569	244,195
1897	130,040	20	63,738	3,370	67,098	—	1,957	—	1,873	—	15,262	—	—	—	36,968	162	46,317	243,845
1898	148,260	8	75,214	2,998	77,620	—	1,903	—	1,922	—	14,241	—	—	—	36,984	114	49,114	274,894
1899	160,000	—	72,378	1,874	73,762	—	2,862	—	1,648	—	16,630	—	—	—	36,714	136	48,989	370,737
1900	130,000	180	70,549	2,973	74,702	—	2,699	—	1,939	—	17,019	—	—	—	33,158	163	53,908	258,606

has increased by 71,000 tons. The home supply has decreased by 17,000 tons. Distinguishing the sources of supply of cheese, it is seen from Table V. that the import of Colonial cheese has increased since 1891 by 31,500 tons, while that from foreign countries has diminished to the extent of 6,900 tons. The actual imports of both kinds in 1891 were: Colonial, 43,228 tons (of which 41,375 came from Canada), and foreign, 60,816 tons. In 1900 the figures are: Colonial, 74,702 tons (70,549 being Canadian), and foreign, 53,903 tons. In Colonial imported cheese it is thus seen that Canada virtually has the field to itself, for the only other Colonial cheese which finds its way here is New Zealand, but the amount of this kind is comparatively insignificant, being only 4,000 tons out of a total import of 128,600 tons. Australia has, during several seasons since 1891, sent small quantities, but they are not worth quoting. The Canadian import shows a steady increase from 1891 to 1898 but since then it has declined by nearly 5,000 tons, apparently because the Canadian dairymen have turned their attention more particularly to the export of butter, which has increased in the period by 6,000 tons. Although the import of New Zealand cheese is comparatively small, it shows on the whole a steady increase, the total for the five years ending 1895 being 10,980 tons, while for the last five years it is 14,089 tons.

From Foreign countries the decline in the export of cheese is mainly in the case of the United States, which sent 10,000 tons less in 1900 than in 1891. France also is losing its cheese trade in British markets, and is being supplanted by Belgium. In 1891 France supplied over 3,000 tons, this year the import was below 2,000 tons. Belgium in 1891 supplied less than 1,000 tons, but now contributes 2,500 tons. The import trade in Dutch cheese remains almost absolutely stationary. In 1891 it amounted to 15,300 tons, in 1899 it was 15,600 tons. This year, owing to exceptionally high prices here, which stimulated the manufacture, it reached 17,000 tons, but this seems likely to be only a temporary increase.

Table V. shows in detail the Home production and imports of cheese since 1891.

#### HOME PRODUCTION OF MILK, BUTTER, AND CHEESE.

That farmers in the United Kingdom are paying more attention to dairy farming than they did a few years ago is evidenced by the steady growth of the milking herds year by year. The severe drought in the year ended June 30, 1894, played havoc among dairy farmers, for it reduced the number of "cows or heifers in milk or in calf" by 106,400, and the following year the number was further reduced by another 88,500, which was due to the supply of young heifers being insufficient to replace the cows which were removed from the dairy herd by old age, death, or barrenness. From the year 1895 there has been a slow but steady increase in the number of cows and heifers until last year and the present, when the increase numbered 51,300 and 97,700 respectively. This augmentation of

TABLE VI.—*Estimated Annual Production of Milk, Butter, and Cheese in the United Kingdom from 1887 to 1900:*

Year ended June 30	Total number of cows and heifers in milk or in calf on June 1	Number of cows per 1,000 of population	Number of cows and heifers giving milk all the year round; say 7½ per cent. of total	Influence of season. Percentage above or below the average of previous 10 years	Estimated total quantity of milk produced in the 52 weeks by 7½ per cent. of the total herd, at 49 cwt. or 531 gallons per cow	Estimated total quantity of butter produced in the 52 weeks, taking 23 per cent. of the total milk to yield 80 lb. of butter per ton of milk	Estimated total quantity of cheese produced in the 52 weeks, taking 20 per cent. of the total milk to yield 220 lb. of cheese per ton of milk
1887	3,974,476	109.4	2,980,857	+ 2.6	Tons 7,492,980	Tons 85,634	Tons 147,170
1888	3,946,259	107.8	2,959,694	- 5.3	6,866,934	78,479	134,886
1889	3,853,002	104.4	2,889,752	+ 5.6	7,476,365	85,444	146,856
1890	3,814,693	102.6	2,860,945	+ 5.3	7,380,808	84,351	144,980
1891	3,956,220	105.5	2,967,165	+ 3.0	7,487,640	85,572	147,078
1892	4,117,707	108.9	3,088,281	Average	7,566,288	86,472	148,624
1893	4,120,451	108.1	3,080,889	- 5.6	7,147,337	81,684	140,394
1894	4,014,055	104.4	3,010,542	- 9.0	6,712,004	76,709	131,843
1895	3,925,486	101.2	2,944,115	+ 6.3	7,667,505	87,628	150,611
1896	3,937,690	100.5	2,953,198	- 3.5	6,982,087	79,662	137,148
1897	3,958,762	100.0	2,969,387	- 4.0	6,983,999	79,817	130,000
1898	3,984,167	99.7	2,988,126	+ 3.1	7,547,858	86,261	148,260
1899	4,035,501	100.0	3,026,526	+ 3.2	7,645,105	87,373	150,171
1900	4,133,249	101.9	3,099,937	- 3.5	7,329,027	83,760	130,020
Last 10 Years Average	4,018,318	103.0	3,013,660	- 0.7	7,906,874	83,992	141,412

NOTE.—In estimating the quantity of milk, butter, and cheese produced within the United Kingdom for each of the last ten years, the "average milking life" of a cow is taken to be four years, from which it follows that on the average one-fourth of the total herd has to be removed every year by heifers with their first calf. This leaves 75 per cent. of the total herd giving milk throughout the year. Each cow of this 75 per cent. is estimated as yielding 49 cwt. or 531 gallons of milk annually. It is assumed that 15 per cent. of the total milk yield is used for the calf, 33 per cent. is utilised for butter-making, 20 per cent. for cheese, and the remaining 33 per cent. consumed in the household as fresh milk. A ton of milk produces 80 lb. of butter or 220 lb. of cheese. A gallon of milk weighs 10.5 lb. (10½ lb.). The probable effects of each season upon the production have been fully considered in making these estimates.

the milking herd of the United Kingdom by 149,000 in two years has raised it to the highest number during the past 14 years. From Table VI. it will be seen that though the milking herd has been steadily growing since 1895, it was not until last year that it overtook the growth of the population, when the number of cows per thousand persons rose from 99·7 to exactly 100·0. This year it has risen by nearly two cows per thousand, and now stands at 101·9. The average for the last ten years is 103·0, so that there is still considerable ground to be recovered.<sup>1</sup>

The quantity of milk estimated as produced by the 4,133,000 cows and heifers in the milking herd of the United Kingdom for the year ended June 30 last was 7,329,000 tons, and the amount of butter in the same period was 83,760 tons, which was a reduction in milk and butter on the previous year of 316,000 tons and 3,600 tons respectively. In cheese the reduction was much greater than in butter, as very deficient pastures were experienced during four out of the six months of the cheese-making season, and it is estimated that the production of cheese fell from the high amount of 150,000 tons in the previous year to 130,000 tons, or a decline of over 13 per cent., while the production of butter fell only 4 per cent.

#### PROSPECTS FOR NEXT SEASON.

*Butter.*—The anticipation that the supplies of Australasian butter would be considerably larger during the season 1899–1900 has been more than justified. It would be almost unreasonable to expect an equal increase in the coming season, but still there is every appearance of a large augmentation in the supplies during the season 1900–1901.

The Canadian supply most probably will show another large development, but it is unlikely that the United States will supply more than they have done in the past season.

From the Continent of Europe larger imports are almost certain to come, as, owing to the drought and heat which existed during the latter half of 1899, the Continental production was very largely restricted, and the imports from this source alone, during the year ended June 30, were reduced by 8,000 tons. In the ordinary course of things, therefore, an augmented supply may be expected during the coming season.

*Cheese.*—The manufacture of cheese during the past two seasons has proved more profitable than the making of butter, and as there appears a reasonable prospect of this state of things continuing during another season, the supply of cheese is likely to be enlarged, especially if the weather for the remainder of the cheese season continues favourable for its manufacture.

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<sup>1</sup> In their monthly report, dated September 7, 1900, Messrs. Weddel say: "The Agricultural Returns for Great Britain show that on June 4, this year, the milking herd was 50,000 cows below last year, which was 97,000 above 1898. This shortage of cows will cause a deficiency in English butter of over 8,000 tons." The official figures are given on p. 551.—ED.

# RECENT AGRICULTURAL INVENTIONS.

*The subjects of Applications for Patents from June 4  
to September 4, 1900.*

N.B.—Where the Invention is a communication from abroad, the name of the Inventor is shown in *italics*, between parentheses, after the name of the applicant.

## Agricultural Machinery and Implements, &c.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
10449	EDDLESTON, T. . .	Mowing and reaping machines.
10475	AINSWORTH, F. . .	Horse-gear for driving chaff-cutters, &c.
10571	KIEHNE, A. . .	Extirpating weeds in fields.
10632	BAMLETT, A. C. . .	Mowing and reaping machines.
10636	EVANS-JACKSON, J. E. ( <i>Milwaukee Harvester Co., U.S.A.</i> ) . . .	Mechanism for operating switch of harvester rakes.
10802	HORNSBY, W., & LAW- SON, J. . .	Ploughshares.
10823	MCBRIDE, W. . .	Turnip-thinning machine.
10871	MOTE, F. F. . .	Cultivator.
10954	LEWIS, A. . .	Machine for "cutting-out" turnip plants.
10997	VON GISLACH, D. . .	Potato-digging and ploughing machine.
11050	PRIESS, A. . .	Spreading dung.
11154	GRACE, J. . .	Potato diggers.
11198	HORNSBY, W., & anr. . .	Ploughshares.
11352	MARKS, G. C. . .	Preserving hops, &c.
11509	IRVINE, A. J. . .	Harvesting machine for turnips, &c.
11632	RICHARDS, P. B. . .	Harvesting machines.
11626	YOUNG, D. . .	Collecting and loading hay.
11631	DOBBING, J. . .	Haymaking machine.
11733	THE BRITISH POTATO HARVESTER SYNDI- CATE, LTD. . .	Potato-digging machines.
12094	FOLEY, A. . .	Seed drills.
12207	BATTS . . .	Stacking hay, &c.
12366	HORNSBY, W., & anr. . .	Knife-driving mechanism for mowing, &c., machines.
12479	BOWMAN, T. . .	Lifting hay.
12507	NICHOLSON, E. H. . .	Horse rakes.
12541	LISTER, W. Y. . .	Corn-cleaning machine.
12652	SCOUJAZ, J. . .	Cultivator.
12696	BLACKSTONE, E. C., & anr. . .	Swath turners.
12867	KANE, M. . .	Finger-bars for mowing machines.
12895	ROTH, O. . .	Artificial manures.
13208	BLUMSCHEIN, E. . .	Turnip-thinning machines.
13438	PHILLIPS, W. E. . .	Digging tools.
14112	HOYER, R. C. . .	Fertiliser distributors.
14369	HADDAN, R. . .	Mowing or reaping machines.
14470	CHRISTIAN, J. J. . .	Machine for ricking hay.
14580	VASS, J., & anr. . .	Ploughs.
14861	SCHULZE, F. . .	Potato-harvesting machine.
14883	TRISSEL, F. N. . .	Machine for loading hay.
14904	PRITT, R. . .	Manures.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
15114	MARSDEN, A. . .	Digging potatoes.
15162	LEDSON, G. . .	Digging and gathering potatoes.
15362	PIM, J. H. . .	Reapers and harvesters.
15529	EDWARDS, E. . .	Sowing seeds at differently regulated distances.
15641	ROWLAND, S. R. & C. .	Horse-hoes.

### Stable Utensils and Fittings—Horse-shoes, &c.

10687	STUART, J. W. R. . .	Preventing harnessed horses from falling.
10791	MAECELLOF, H. C. . .	Horse-shoes.
10792	" " . .	Fastening caulks to horse-shoes.
10793	" " . .	Forming toe-clips upon horse-shoes.
10867	LEES, W. . .	Cart-saddle.
11027	WILKINSON, H. . .	Horse-shoes.
11064	BARK, H. . .	Feed-bags.
11115	HENRICI, G. J. . .	Check-hooks and harness-hangers.
11131	WINTERTON, T. . .	Bridle attachment.
11237	HARRISON, E. . .	Saddles.
11331	LORD, J. MCC. . .	Horse-shoes.
11341	NIELSON, N. A. . .	"
11418	SELF, F. . .	Harness.
11478	DEAN, J. . .	Changeable rubber pad.
11832	HAEWOOD, J. . .	Hames and collars.
11949	RICHARDS, J. W. . .	Leg-guard or shield attachment.
11954	WILLIS, A., & anr. . .	Instant-release trace.
12040	NEAL, E. . .	Non-slipping horse-pad.
12084	CRADDOCK, A. . .	Bridle-bits.
12210	SEWELL, H. J., & anr. .	Horse-collars.
12294	HARRISON, E. . .	Pommels of side-saddles.
12417	CHAPMAN, B. F. . .	Horse-collars.
12595	NICHOLLS, F. V. . .	Side-saddles.
12999	MILLER, R. . .	Nailless horse-shoe.
13093	ORR, S. . .	Frost stud for horse-shoes.
13190	QUIGNON, L. V., & anr. .	Stirrup-buckles.
13353	CLARK, W. T. . .	Horse-clippers.
13411	LAKE, H. H. ( <i>Anderson, J. R., Sweden</i> ) .	Hames.
13465	SPONG, J. F. . .	Sunshades for horses.
13567	WILLIAMS, J. R. . .	Horse-shoe calks.
13612	WARD, C. H. . .	Protecting horses' heads from the sun.
13961	WEST, C. A. . .	" "
13988	WENDLER, F. . .	Fastening-device for draught-chains, &c
14006	PLANT, W. H. . .	Horse-clipping machines.
14210	KENNEDY, W. . .	Horse-shoes.
14221	SMITH, G. F. . .	Sun-shield or bonnet.
14264	SAUNDERS, F. . .	Collars.
14977	SMITH, H. G. . .	Head-screen for horses.
15031	MUSSON, T. . .	Harness-saddles.
15386	FORD, L. P. . .	Horse-collars.
15425	TURNER, A. W. . .	Horse-shoes.
15555	JENNINGS, W. . .	Screwed studs for horse-shoes.
15609	FRANKENSTEIN, E. R. .	Training horses.

### Dairy Utensils, &c.

10665	LAWRENCE, W. H., & KENNEDY . . .	Milking apparatus.
10877	PORTER, A. J. . .	Cheese-cutter.

No. of Application.	Name of Applicant.	Title of Invention.
Year 1900.		
10882	DRAPER, B., & DUTTON, W.	Milk-cans.
12191	LAWSON, W. T.	Milk-safe.
12331	IMRAY ( <i>Farbwerke vorm. Meister, Lucius &amp; Bröning, Germany</i> )	Process for rendering cows' and goats' milk digestible.
13826	MACARDLE, J.	Treatment of milk.
13853	BELL, E. D.	Preparation of cheese.
14315	SLOAN, M.	Dairy utensil.
14724	STAUF, R.	Obtaining the solid constituents of milk as a dry powder.
15649	POPPE, M.	Manufacture of artificial butter.

### Poultry and Game, &c., Appliances.

10769	NEAVEHSON, M. A., & R.	Poultry-house.
11548	RANDELL, J.	Bird fountains, or food-hoppers.
11619	WYATT, G.	Egg-testing apparatus.
11722	WEBB, T., & anr.	Drinking fountain and food-box for travelling baskets.
11975	FREEMAN, H. H.	Foster mother.
12621	BENDAR, C.	Feeding-trough for poultry, &c.
12880	TIMAR, T.	Breeding apparatus for chickens.
13319	CHAFER, W. T.	Automatic adjuster for raising and lowering portable fowl-houses.
15160	TIMAR, T.	Incubators.
15719	WHITBY, W. G.	Double-automatic incubator.

### Miscellaneous.

11854	HORNER, W.	Beehives.
11855	" "	Bar frames.
12621	MCDUGALL	Sheep-dipping preparations.
12880	TIMAR, T.	Breeding apparatus.
13273	STACK, T. L.	Treating milk at dairies.
13454	TURNER, S. N.	Leaving milk-cans at doors.
13940	VAURY, A. H.	Cattle food.

### Numbers of Specifications relating to the above subjects published since June 4, 1900.<sup>1</sup>

(Price 8d. each copy.)

#### Specifications of 1899.

12408, 12892, 13792, 13963, 14058, 14463, 14634, 15422, 15794, 16058, 16181, 16185, 16442, 16581, 16758, 16958, 17077, 17150, 17841, 18122, 18149, 18304, 18426, 18984, 19161, 19592, 19874, 19953, 20274, 20898, 20984, 22002, 22458, 22850, 23561.

#### Specifications of 1900.

6896, 7361, 7390, 7672, 7898, 8147, 8752, 9235, 9292, 9310, 9421, 9426, 9428, 9453, 9586, 10032, 10067, 10151, 10571, 10791, 10792, 11548, 11619, 12867, 13411.

<sup>1</sup> Copies may be obtained at the Patent Office (Sale and Store Branch), Quality Court, Chancery Lane, London, E.C.

# STATISTICS AFFECTING BRITISH AGRICULTURAL INTERESTS.

## AGRICULTURAL RETURNS OF GREAT BRITAIN, 1900.

PRELIMINARY STATEMENT for 1900, compiled from the Returns collected on June 4; and comparison with previous Years.

### A.—1900 and the two previous years.

CROPS	1900	1899	1898
	Acres	Acres	Acres
Wheat . . . . .	1,845,042	2,000,981	2,102,306
Barley . . . . .	1,990,365	1,982,108	1,903,666
Oats . . . . .	2,026,086	2,952,756	2,917,760
Potatoes . . . . .	561,261	547,682	524,591
Clover & Rotation { For Hay . . .	2,201,781	2,214,888	2,281,551
Grasses { Not for Hay . . .	2,587,377	2,582,068	2,829,799
TOTAL . . . . .	4,789,158	4,807,951	4,911,350
Permanent Pasture { For Hay . . .	4,372,099	4,339,085	4,536,315
{ Not for Hay . . .	12,365,936	12,291,662	12,022,077
TOTAL . . . . .	16,729,035	16,630,747	16,559,392
Hops . . . . .	51,206	51,843	49,735

LIVE STOCK	No.	No.	No.
Cows & Heifers in Milk or in Calf . . .	2,620,901	2,671,290	2,587,180
Other Cattle :—2 years & above . . .	1,372,522	1,341,210	1,361,296
" 1 year & under 2 . . .	1,460,806	1,388,611	1,245,844
" Under 1 year . . .	1,350,929	1,394,639	1,307,735
TOTAL OF CATTLE . . .	6,805,170	6,795,739	6,632,964
Ewes kept for Breeding . . .	10,350,326	10,460,837	10,187,922
Other Sheep :—1 year & above . . .	5,962,869	6,040,800	6,362,828
" Under 1 year . . .	10,278,031	10,737,217	10,401,464
TOTAL OF SHEEP . . .	26,592,226	27,238,764	26,742,194
Sows kept for Breeding . . .	322,521	375,911	362,200
Other Pigs . . . . .	2,049,411	2,247,902	2,082,235
TOTAL OF PIGS . . .	2,381,932	2,623,813	2,441,395

B.—1900 compared with 1899.

CROPS	Increase		Decrease	
	Acres	Per cent.	Acres	Per cent.
Wheat . . . . .	..	0.4	155,989	7.8
Barley . . . . .	8,157	0.4	..	..
Oats . . . . .	66,833	2.2	..	..
Potatoes . . . . .	13,679	2.5	..	..
Clover & Rotation { For Hay . .	..	..	13,103	0.6
Grasses { Not for Hay .	..	..	35,691	1.4
TOTAL . . . . .	..	..	48,793	1.9
Permanent Pasture { For Hay . .	34,014	0.8	..	..
{ Not for Hay	64,374	0.5	..	..
TOTAL . . . . .	98,388	0.6	..	..
Hops . . . . .	..	..	535	1.0

LIVE STOCK		No.	Per cent.	No.	Per cent.
Cows & Heifers in Milk or in Calf .		31,323	3.3	50,359	1.9
Other Cattle :— 2 years & above .		72,397	5.2	..	..
" " 1 year & under 2 .		..	..	..	..
" " Under 1 year .		..	..	43,710	3.1
TOTAL OF CATTLE .		9,450	0.1	..	..
Ewes kept for Breeding . . .		..	..	110,511	1.1
Other Sheep :— 1 year & above .		..	..	76,731	1.3
" " Under 1 year .		..	..	459,386	4.3
TOTAL OF SHEEP .		..	..	646,528	3.4
Sows kept for Breeding . . .		..	..	43,390	11.5
Other Pigs . . . . .		..	..	198,491	8.8
TOTAL OF PIGS . . .		..	..	241,881	9.2

ACREAGE OF HOPS.

PRELIMINARY STATEMENT compiled from the Returns collected on June 4, 1900, showing the ACREAGE under HOPS in each COUNTY of ENGLAND in which Hops were grown, with a COMPARATIVE STATEMENT for the Years 1899, 1898, and 1897.

COUNTIES	1900	1899	1898	1897
	Acres	Acres	Acres	Acres
Gloucester . . . . .	47	43	40	40
Hants . . . . .	3,331	2,819	2,363	2,306
Hereford . . . . .	7,237	7,327	6,651	6,543
Kent . . . . .	31,514	31,368	30,941	31,661
Monmouth . . . . .	—	—	3	3
Salop . . . . .	138	138	126	129
Suffolk . . . . .	4	4	3	3
Surrey . . . . .	1,300	1,368	1,313	1,416
Sussex . . . . .	4,823	4,949	4,829	5,174
Worcester . . . . .	3,964	3,788	3,567	3,991
TOTAL . . . . .	51,308	51,843	49,735	50,963

NOTE.—The following counties show *increases*, to the extent named, in 1900 :— Worcester, 176 acres; Hereford, 60 acres; Gloucester, 5 acres. The *decreases* are: Kent, 474 acres; Sussex, 126 acres; Hants, 88 acres; Surrey, 88 acres. The effective *decrease* on the year is 535 acres.

**Areas of Cereal Crops, Potatoes, and Hay, and Numbers of Cattle, Sheep, and Pigs in England, Wales, Scotland, and Great Britain (as returned on June 4) in 1900 and (on June 5) in 1899.**

Crops	England	Wales	Scotland	Great Britain
	Acres	Acres	Acres	Acres
WHEAT . . . { 1900 1899	1,744,556 1,899,827	51,654 53,898	48,832 47,256	1,845,042 2,000,981
<i>Difference in 1900 . .</i>	-155,271	-2,244	+1,576	-155,939
BARLEY . . . { 1900 1899	1,645,022 1,635,634	105,048 105,978	240,195 240,496	1,990,265 1,982,108
<i>Difference in 1900 . .</i>	+9,388	-930	-301	+8,157
OATS . . . { 1900 1899	1,860,513 1,781,649	216,447 220,233	949,128 957,873	3,026,088 2,959,755
<i>Difference in 1900 . .</i>	+78,864	-3,786	-8,745	+66,333
POTATOES . . { 1900 1899	396,936 387,715	33,225 32,982	131,200 126,986	561,361 547,682
<i>Difference in 1900 . .</i>	+9,221	+243	+4,215	+13,679
HAY FROM CLO- VER AND ROTA- TION GRASS { 1900 1899	1,598,566 1,622,603	196,992 198,046	406,223 394,234	2,201,781 2,214,883
<i>Difference in 1900 . .</i>	-24,037	-1,054	+11,989	-13,102
HAY FROM PERMA- NENT GRASSLAND { 1900 1899	3,776,473 3,753,867	464,870 457,173	131,756 128,045	4,373,099 4,339,085
<i>Difference in 1900 . .</i>	+22,606	+7,697	+3,711	+34,014
Live Stock	No.	No.	No.	No.
CATTLE . . . { 1900 1899	4,848,698 4,841,852	758,386 736,691	1,198,086 1,217,177	6,805,170 6,795,720
<i>Difference in 1900 . .</i>	+6,846	+21,695	-19,091	+9,450
SHEEP . . . { 1900 1899	15,844,713 16,261,417	3,432,516 3,416,357	7,314,997 7,560,980	26,592,226 27,238,754
<i>Difference in 1900 . .</i>	-416,704	+16,159	-245,983	-646,528
PIGS . . . { 1900 1899	2,021,422 2,225,420	228,097 258,154	132,413 140,289	2,381,932 2,623,813
<i>Difference in 1900 . .</i>	-203,998	-30,057	-7,826	-241,881

NOTE.—The *Difference* lines show the increase (+) or decrease (−) in 1900, as compared with 1899.

# JOURNAL

OF THE

## ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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### THE WOBURN POT-CULTURE STATION.

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### INTRODUCTORY—THE VALUE OF POT-CULTURE EXPERIMENTS.

THE system of conducting agricultural experiments by growing plants on a small scale in pots instead of on plots of a field is of comparatively recent introduction. It is from Germany that the methods of pot-culture experimentation have come to us. Hellriegel and Wilfarth at Bernburg, Wagner at Darmstadt, Maercker at Halle, Takke at Bremen, and others have popularised and extended the application of the methods.

and have had numerous followers. It is perhaps, however, to Professor Paul Wagner of Darmstadt that the system mostly owes its present expansion, and it has now extended to the experimental stations of the Continent and America.

It is the Royal Agricultural Society of England who can claim, so far as the United Kingdom is concerned, the establishment of the first regular Pot-culture Station, in connection with the Woburn Experimental Farm, where field experiments have been continually in progress since the year 1877, and which owe their inception and continuance to the liberality of successive Dukes of Bedford. The inauguration of the Pot-culture Station is in great measure due to a bequest made at the close of 1896 to the Royal Agricultural Society by the late Mr. E. H. Hills, of Deptford, who by his will left a sum of money to be devoted to carrying out agricultural experiments on the value of "the rarer forms of ash," which constituents he considered to possibly exercise a greater influence upon the growth of agricultural crops than had been generally believed.

In approaching the problem thus put before them, the Chemical Committee of the Royal Agricultural Society of England felt that the best way of carrying out the testator's intention was to adopt the new system of "pot-culture" experiments; and, as the outcome, the Woburn Pot-culture Station was founded. The buildings were commenced in April 1897, and were ready for occupation by the beginning of 1898.

Before going into particulars respecting the plan and buildings of the Woburn Pot-culture Station it is well to indicate briefly the main points which distinguish "pot-culture" experiments from "field" experiments, and to compare the special advantages and disadvantages of the two systems.

1. In pot-culture one is practically independent of those external conditions of season and weather which exercise such a great and varying influence upon the produce of field crops. The plants, being protected, can be secured from the effects of frost and extreme heat, from wind, hail, and rain-storms, from excessive rainfall or continued drought. The plants can be exposed to sun and light when favourable, or be run in under cover when atmospheric conditions are unsuitable. Water can be supplied as the plants require it and not as rain happens to fall, or it can be withheld. Depredations by birds can be prevented and insect attacks at once detected.

2. In pot-culture one is independent of the mechanical cultivation of the soil and of its condition as affected by season

and weather; any requisite degree of fineness of soil can be obtained by previous preparation of the soil used.

3. In pot-culture one is free from the difficulties arising so often in field experiments through inequalities of soil. It is well known that a different vein of land, a sour spot, an unevenness in the "lay" of land, a variation in the depth or nature of top- or sub-soil, the nearness of water or of rock to the surface, and other such causes may make land yield differently, and if these irregularities occur to any considerable extent they may vitiate the results of field experiments. In pot-culture, on the other hand, these inequalities do not occur, for the soil used can be intimately mixed so as to be absolutely uniform, and analysis of it will represent its composition much more definitely than will that of a sample of soil taken direct from a particular spot or spots in an experimental field.

4. In a field experiment one is tied down to the particular soil of that field. In pot-culture this is not so, for many different soils may be experimented with side by side, and the results be obtainable not only for the particular field or even locality where the experiment is tried, but for any soil and for any locality. Thus, at one such Station experiments with soils of different parts of the country can be carried on simultaneously.

5. In regard to manuring there are further advantages in pot-culture. Not only is much better and more even distribution of the manures employed obtained, and inequalities on this score obviated by intimate mixing of the manures with the soil, but the great difficulty in field experiments, that a soil or plot of land once manured in a certain way has to be considered subsequently in relation to that application of manure and may be affected by it for several years, is avoided, since all that one has to do when the particular experiment is over is to turn the soil out of the pot and start again. This obviously cannot be done in the case of a field. Similarly, the growing of one crop, as *e.g.* clover, will have an influence upon the subsequent one in a field, but this can be avoided in pot-culture.

6. In a field experiment the number of different issues put to the test must of necessity be a limited one—only a certain number of different manures can be tried, or the plots employed will be too small to ensure accuracy. In pot-culture one need have no such limitation. The duplication, under precisely similar conditions, of manurial trials is also much facilitated and the results are thus more readily checked.

7. There are great conveniences in the ease of handling pot-culture experiments. Results can be more readily attained and need not be continued over so long a period as field

experiments. If anything goes wrong the pots can be turned out and the experiment started again with fresh soil or fresh manuring. It is much easier to note appearances of crops and changes in them, the whole being under close and daily observation, and these relative appearances can be at any time photographed and kept on record.

On the other hand there are necessarily disadvantages attached to the pot-culture system. These are mainly :—

1. That the experiments, being conducted on a small scale, are really only of value in a *comparative* direction. They are not necessarily the reflex of what takes place in the field on the practical scale. Neither the mode of growth nor the bulk of crop will be the same as when the crop grows in a field, and calculations of crop return based on the multiplication of a small area will be fallacious when reckoned out, say, to the acre. The most that can be said is that the results are strictly comparable among themselves. From this it follows that practical men, accustomed to judge by the yield per acre, will not put credence on what is grown on a small area under conditions more or less unnatural.

2. It is impossible to imitate in pot-culture those mechanical and physical conditions of soil which, it is known, affect to so large an extent the growth and out-turn of crops.

3. The absence of natural drainage, the artificial watering, the shallow depth of soil, its want of consolidation, the rapid penetration of warmth laterally as well as downwards, and the protection from extremes of weather constitute conditions different from those met with in a field, and the result is a more or less unnatural growth, a matting together of roots at the base of the pots, and a growth at times too rapid, at others stunted. Added to this are other disadvantages, such as the greater liability to blight and fungoid attacks, and a general want of strength about the plants grown thus more like hot-house plants. If, too, out of a limited number of plants in a pot some get damaged or die, their replacement that season is impossible, whereas, in a field, variations from such causes are equalised by the large area over which they are spread. Certain crops, moreover, such as root crops, are not ordinarily capable of being experimented on in pots, as the results from single roots would be very misleading.

Altogether then, in my opinion, while pot-culture presents great advantages, and mainly in the way of facilitating the carrying out simultaneously of a very large number of experiments and on different soils, and enables results of a comparative nature to be much more readily obtained and with much

greater convenience in respect of manipulation, labour, time, and cost than in field experiments, they cannot and should not be considered as *replacing* field experiments, but rather as being supplementary to, and to be used *in conjunction with* the latter. Pot-culture experiments should, I think, be rightly used as a most convenient method for *sorting out* from a number of comparative trials those methods or that treatment which it is desirable to apply subsequently on a practical scale in the field. By pot-culture one is enabled to get a very good idea as to what is worth trying on the larger area, and of rejecting what is likely to be useless. But pot-culture experiments should, I certainly think, not stand by themselves, for they need the confirmation of field experiments before full credence can be placed upon them and before they can be considered as having a distinct bearing upon practice.

And thus the establishment of a Pot-culture Station at Woburn, side by side with the field experiments, supplies what, to my mind, is a valuable adjunct to, rather than a replacement of, the older field experiments. It will be possible now to study more closely in detail many of the problems which have been brought to light in the course of the field experiments, and it will be possible also to try tentatively a number of new suggestions before committing oneself to the adoption of any of these in such a way as to render the land upon which they are tried useless for other experiments for at least some time to come. The Hills experiments, an account of which follows later, afford a very good instance of what I have set out. In these a large number of constituents ("rare forms of ash" as they are called in the terms of the bequest) are selected to be experimented with. The forms in which and the ways in which these can be used are very varied, and it would be almost hopeless to attempt to try all of them in the field. By the pot-culture system, however, it is possible, as I shall show later, to conduct a large number of experiments side by side, and to eliminate from them those that show no signs of being of practical value, while others that bid fair to afford useful results in practice can be selected for further trial on the practical scale.

Having thus set out what, in my opinion, are the proper relative positions to be occupied by pot-culture experiments and field experiments, and having shown the reasons for the inception of the Woburn Pot-culture Station, I take next in order the buildings and general arrangement of the Station.

## THE POT-CULTURE BUILDINGS AT WOBURN.

It was desirable, in the first place, to have the pot-culture experiments where they would be ready of access and conveniently near both to the farm buildings and the fields. A suitable spot was found in a grass field close by the farmhouse and adjacent to the main road, and the site was chosen so as to give a southern aspect to the part where the plants would be, and where they would receive for the longest time both light and warmth. This part of the field was levelled, and the bottom made firm with ballast.

The buildings, a general view of which is given in fig. 1, p. 560, consist of three distinct parts: *a*, on the right of the picture, a brick building comprising the laboratory, office, and store-room; *b*, in the centre, a conservatory or glass-house resting on a low brick wall; and *c*, on the left of the picture, a space covered in with wire netting, borne on an iron framework, and supported on light girders, forming an arched roof. It is practically a wire enclosure, the whole being covered in with wire, and the wire netting of such mesh that birds cannot get through it.

The land immediately around the buildings is occupied by pits dug in the ground and used for holding different soils required for the experiments, and by a rain-gauge and other meteorological recording instruments. There is also, near the laboratory, an outhouse containing a "dark room" for photographic purposes, and a store-room. The area is further used for supplementary pot or cylinder experiments in the open. The whole is enclosed with a strong iron fence with gates. The fence measures 123 ft. 7 in. by 79 ft. 4 in., the whole area enclosed being thus nearly one-quarter of an acre.

To come to closer details—the laboratory buildings (see fig. 3, p. 562) consist of (*a*) a general chemical laboratory, 24 ft. by 15 ft. 4 in.; (*b*) an office, library, and balance-room, 13 ft. 7 in. by 7 ft. 4 in.; and (*c*) a store and sample room, 18 ft. 7 in. by 7 ft. 3 in., which is used for keeping samples of soil from the various experimental fields and samples of the experimental crops. Water is obtained by pumping from a brook close at hand; there is in the laboratory a still and a condenser for obtaining distilled water, but, owing to there being no gas in the village, the operations of the laboratory that require the use of heat have to be conducted by the aid of oil and spirit lamps. A wind-vane is fixed on the outer wall of the laboratory on the one side, and on the other (front of picture, fig. 1) is a covered porch

with cement floor, 8 ft. 6 in. by 6 ft., which is used for mixing under cover the soils used, and for filling the pots with the soil. The samples in the store-room consist mainly of the soils collected at intervals since 1877, of grain-crops of successive years, of feeding-stuffs used in the feeding experiments at the Woburn Farm, and of manures applied to the different experimental plots.

The glass-house or conservatory is 39 ft. 2 in. by 21 ft., and has a sloping glass roof which is 21 ft. 8 in. at its highest and 8 ft. 6 in. at its lowest point. The roof is whitewashed in summer to keep it cool. This house contains a stand and screen for use in taking photographs. Sliding wooden and glass doors separate it from the third portion of the buildings, the wire enclosure, the general arrangement of which is shown in the illustration (fig. 2, p. 561). It is strongly built and the roof firmly supported; its dimensions are 48 ft. long by 40 ft. broad. The height is 7 ft. 6 in. at the side, and to the highest point of the span 15 ft. 8 in.

The interior of the wire enclosure is laid out with a system of parallel rails, of which there are ten pairs; these are continued into the conservatory, and a further set of rails runs outside the cage to the soil-pits and the porch already mentioned. Thus the trucks bearing the pots can be run out to be filled with soil, or can be put under shelter in the conservatory, or be run out again into the open. The rails are portable and not fixed, being simply laid on the gravel flooring. At the end near the glass-house there is a pair of cross-rails on which a kind of turn-table carriage or trolley (seen in fig. 2) runs, and enables any truck on the lines to be diverted to another pair of rails or to be sent outside the structure, as may be necessary. The trucks that run on the rails are shown in fig. 2. They are of wood, mounted on two pairs of wheels, the flooring being of strips of wooden board; there is an iron rail at either end to enable the trucks to be moved about or run into the glass-house when there is need. The whole of this part of the work (the line of railway, the trucks, &c.) was carried out by Messrs. J. & F. Howard, of Bedford, and has been very satisfactory.

The trucks—of which there are at present eighteen in all—carry the pots in which the plants are grown. The pots used (see fig. 4, p. 563) are of two kinds,—(1) zinc, (2) glazed earthenware.

The zinc pots are circular; they are 10 in. in diameter and 10 in. deep. The design is taken from Wagner's latest model. The interior of each pot is coated with pitch; the tubes for

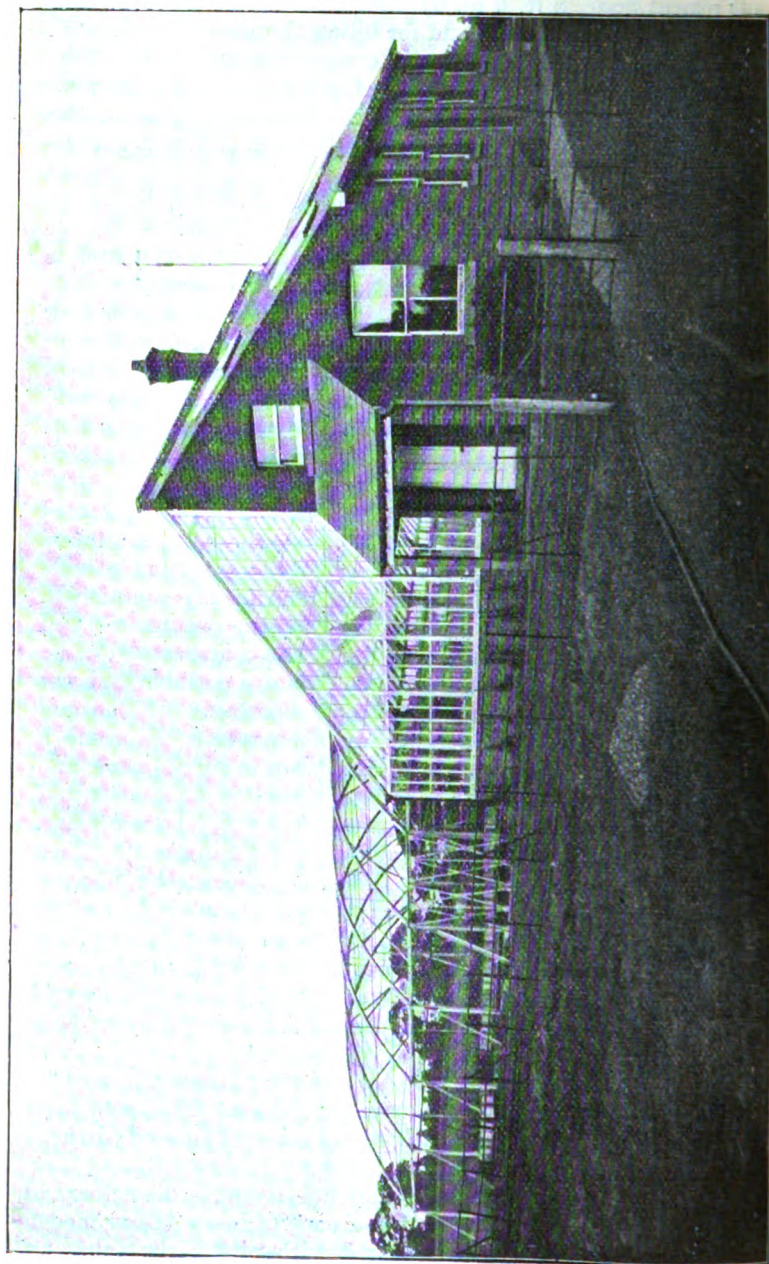


FIG. 1.—General view of Woburn Pot-culture Station.

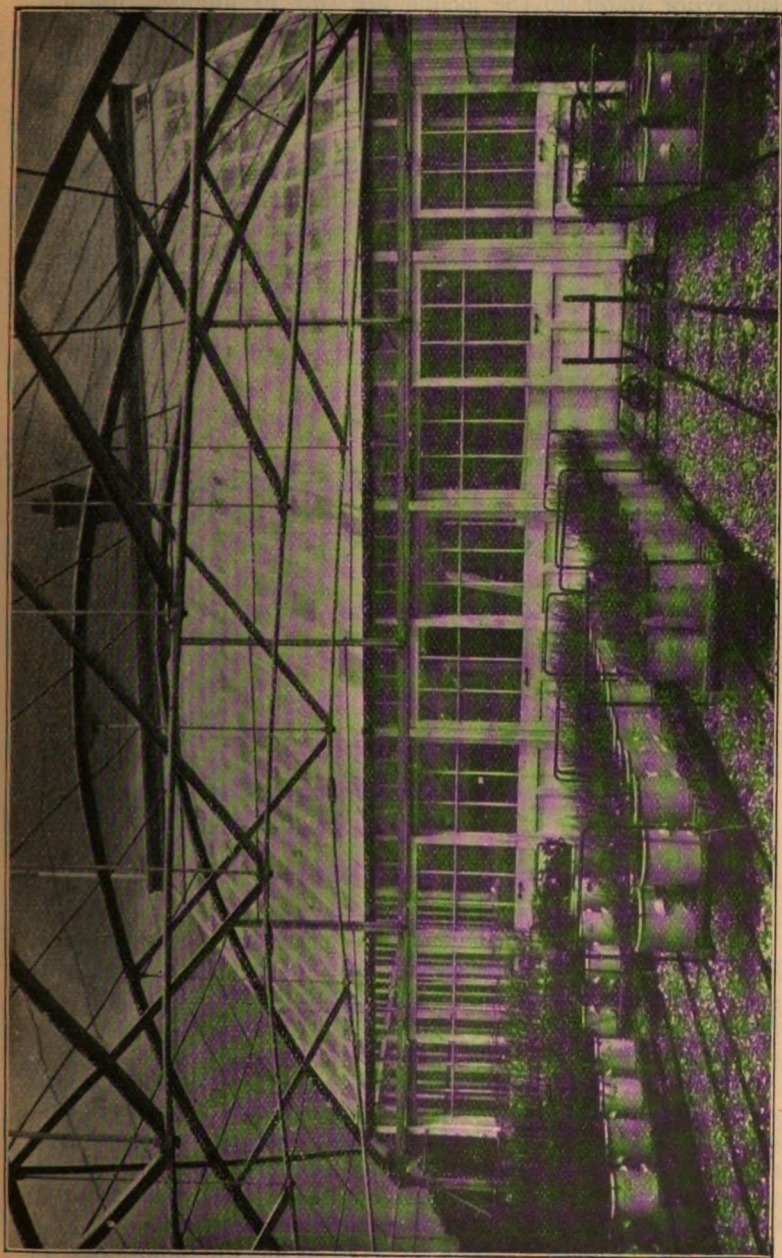


FIG. 2.—Interior of wire enclosure.

supplying water to the plants are two in number, passing down the sides of and inside the pot, reaching to the bottom, where they are connected by an arched piece of zinc with notches cut in it, thus allowing passage of water and air (see fig. 4 b).

The earthenware pots are 11 in. in diameter and 11 in. deep. They are thoroughly glazed inside and outside; they have no tubes passing down into them, but are provided with an inclined spout, which allows of aëration proceeding well. In the case of these pots the water is poured over the surface, and not down special tubes as with the zinc pots.

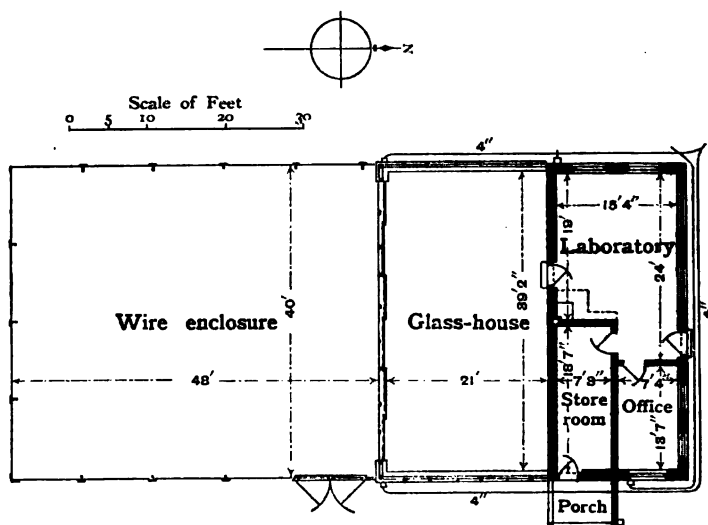


FIG. 3.—Ground plan of buildings.

The experience of the last two years has been decidedly in favour of the earthenware pots. They are something like those employed by Maercker at Halle and Takke at Bremen, and their cost is about 3s. 9d. each, while the zinc pots cost only 3s. 3d. each. In the earthenware pots there is rather more space, the soil in them does not get so much heated as with the zinc pots, the temperature also not varying so rapidly, the method of watering is simpler, aëration seems more satisfactory, and they are generally handier, less liable to leak, and the crops seem to grow better in them. They are made in Staffordshire and the thorough glazing is guaranteed.

A single truck will carry sixteen of the zinc pots, or

fourteen of the earthenware ones. Fig. 5 (p. 564) presents a view of a single truck with its load of pots. Each pot bears a distinctive number.

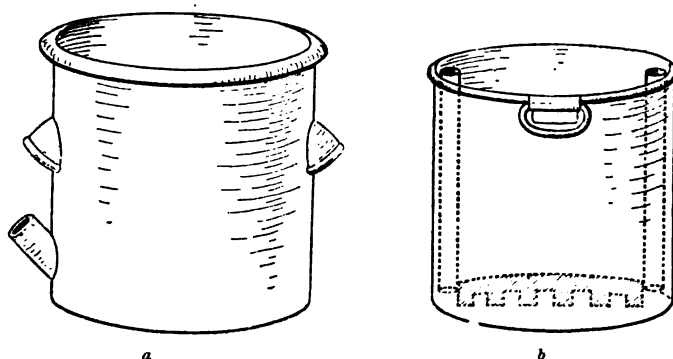


FIG. 4. —(a) Earthenware pots; (b) zinc pots.

The cost of the entire buildings and equipment of the Pot-culture Station has been, roughly, as follows:—

Laboratory buildings . . . . .	£ 434
„ fittings, apparatus, chemicals, &c. . . . .	232
Glass-house . . . . .	142
Wire enclosure . . . . .	170
Rails and trucks . . . . .	103
Pots . . . . .	34
Fencing . . . . .	20
Shed . . . . .	18
Meteorological instruments . . . . .	13
Professional fees in connection with construction of buildings . . . . .	60
	<hr/>
	1,226

## THE METHODS OF POT-CULTURE.

A spare truck is used for carrying a balance and a carboy of distilled water, these being capable of being moved about to any point required. Each pot has its initial weight when first filled, and this weight is kept up, as nearly as practicable, by the addition of distilled water as required.

The filling of the pots is done in stages. First of all comes a layer of sifted gravel about  $1\frac{1}{2}$  inch in depth, and above this the soil to be used in the experiment is placed in successive layers, each layer being left to settle down before more soil is added. This is in order to secure compactness of soil, a very material point in getting consistent results.

Manures, when added in the insoluble state, are well mixed with the last lot of soil introduced; when they are of soluble nature they are dissolved in water and poured on the surface of

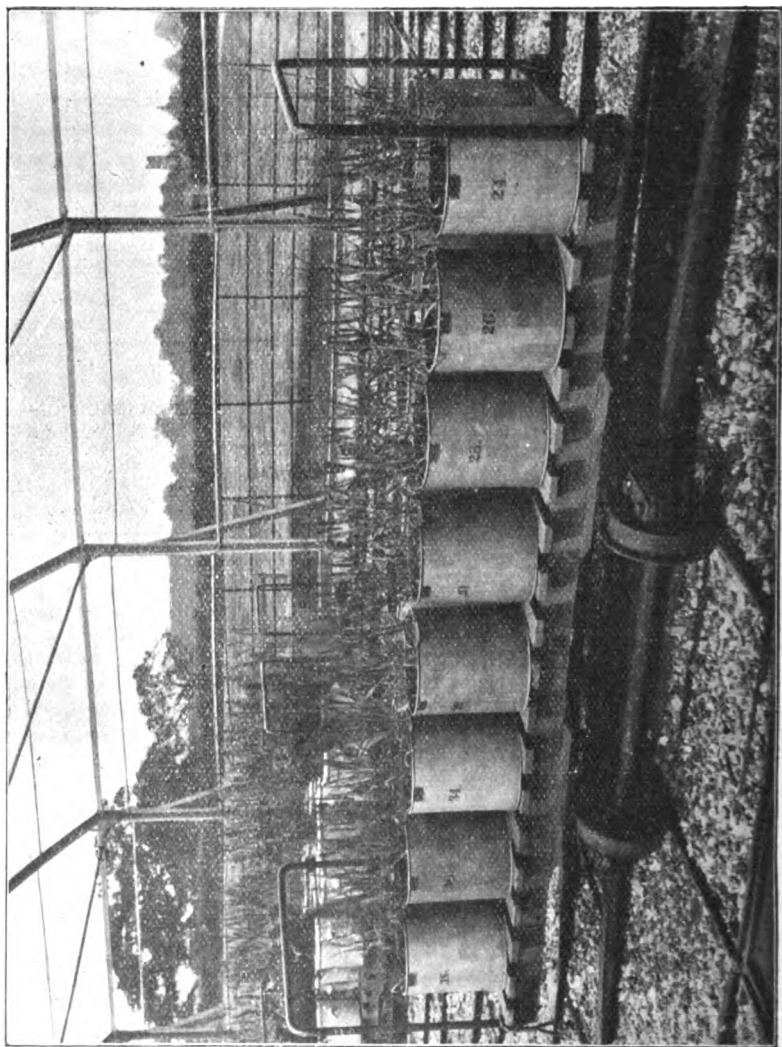


FIG. 8.—A single truck, with its load of zinc pots, placed on trolley for removal whenever wanted.

the soil; generally in a 1 per cent. solution if there be no question of particular strength of solution.

In the soil thus prepared the seed is sown. It is usual to

plant a larger number of seeds than will produce ordinarily the number of plants allowed to come to maturity. Then, when the plants have appeared, the overplus is removed. In the case of corn crops, as a rule 12 seeds are sown and 6 plants allowed to mature. It has, as a matter of fact, been found that the total yield of crop is practically independent of the number of plants left to mature; if a larger number be left the total produce of grain and straw is much the same as if the plants had been thinned out and only a certain number, say six, allowed to develop fully. The time of sowing is generally from two to three weeks later than when the same seed is sown in the field. Experience has enabled us to get over several difficulties which at first presented themselves. There was a tendency then to shelter the plants too much and to water them too liberally, and mould, fungus, &c. were frequently the result. "Green fly" was also a frequent incursor. Such difficulties are to a considerable extent removed after a short practical experience, and it may be said generally that the more the plants are kept in the open, and the less under cover, the better it is for them. Excessive watering must also be avoided. Each pot, as already stated, has its initial weight at starting, which is recorded, and distilled water is added when the plant seems to require it, until the pot has again acquired its original weight. It may be here remarked that when clover is grown in the pots much more water is needed than with wheat or barley, the evaporation from the broad leaves of the clover being more rapid.

In respect of drainage no trouble is experienced after a time. In the first year of the experiments there was considerable trouble, especially when heavy rain fell. But, later on, no difficulty was found, and there was no loss owing to excessive drainage or to the superfluous liquid running out of the spout supplied to the earthenware pots.

Several points have been noticed with regard to the soil. In some cases the action of certain manures or applications has been to cause crusting of the soil, and the breaking up of this has been requisite. In other cases the addition of certain salts, *e.g.* salts of iodine, carbolic acid, &c., has been to cause the soil to smell strongly for some time of the reagent used or its essential constituent. A soil to which sodium iodide was applied, for instance, smelt at first strongly of iodine, while sodium bromide similarly applied gave no corresponding result. It has been possible, by additional experiments, to find out how long these actions have been maintained, and, by testing the drainage water, to ascertain when the removal was complete. The rapid removal

of carbolic acid, for example, from a soil to which it has been applied has been in this way established.

It has been observed that, in addition to the pots in use within the wire enclosure, additional ones, or rather cylinders, of large dimension, have been used in the ground lying outside the enclosure. These are nothing more than ordinary stoneware drain-pipes 2 feet deep and 15 inches in diameter, which are sunk in the earth and are then filled with the soil under experiment. They differ from the pots in not being closed at the bottom, and so they allow of natural drainage into the soil below.

It only remains to say that since the establishment of the Woburn Pot-culture Station the same has been constituted a Meteorological Station of the second order, and corresponds directly with the Meteorological Office. Observations are taken twice a day with the barometer, the wet and dry bulb thermometer (dew point), and the maximum and minimum thermometer; the rainfall, wind (direction and force), cloud (form and amount), &c., are also recorded. This involves the somewhat laborious task of record-keeping and transmission of the observations so taken.

It must be apparent, too, that the notifying of what is done in the numerous pot experiments, the daily observations of appearance of crops, the weighing and watering, the measuring of the growth of crops, and the final gathering, weighing, and subsequent analysing, involve constant care and much labour, and the value of the work is dependent entirely upon the accuracy with which it is performed. A resident assistant-chemist is therefore a necessity. At the time of the inception of the Station this post was held by Mr. H. H. Mann, B.Sc., formerly of the Yorkshire College, Leeds, and, since his removal to India to take up an appointment there, Mr. H. M. Freear, for several years my private assistant in London, has been in actual charge of the Station.

Having thus dealt with the inception and general arrangements of the Pot-culture Station, I pass on to consider in detail the work of the past two years, and I begin with those experiments in connection with which the Station was first established, the "Hills experiments," as they may fitly be called.

#### A. THE HILLS EXPERIMENTS.

Mr. E. H. Hills, a gentleman of scientific training, and one who was much interested in chemical manufacture, chiefly in

its relation to agriculture, was a member of the well-known firm of F. C. Hills & Co., of Deptford, chemical manufacturers and makers of artificial manures. He owned Wickhurst Farm in Sussex, and farmed the land there, interesting himself greatly in agriculture and the application of chemical science thereto. He appears also to have been an extensive reader in agricultural science, and, among other researches, those of Prince Salm-Horstmar impressed him greatly. Mr. Hills published, for private use, shortly before his death—which took place suddenly in 1896, while he was still comparatively young—a book entitled “Wickhurst Farm,” and in this book he set out the main ideas which he had collected from his reading as regards the nutrition of crops, their requirements, and how these might be severally obtained. The part of the work which calls for attention here is that relating to the “ash constituents” of plants, and chiefly the “rarer forms of ash,” as he described them. Recognising the importance of ash constituents in the growth of plants, Mr. Hills proceeded to classify these according to their relative significance. The first set—which he termed “primary ash”—included such essential constituents as phosphoric acid, potash, lime, and sulphuric acid; a second class, “secondary ash,” embraced soda, magnesia, chlorine, oxide of iron, and silica; while the third set, called by him “tertiary ash,” included the “rarer forms of ash, which are not found in most agricultural soils, but which very possibly are essential for perfect plant growth.” Mr. Hills here refers to the experiments of Prince Salm-Horstmar, and adds, “it is . . . quite within the bounds of possibility that tertiary ash may possess an importance at the present time (1891) quite unappreciated.” Continuing, Mr. Hills said, “Tertiary ash includes compounds of *Fluorine*, *Manganese*, *Iodine*, *Bromine*, *Titanium*, and *Lithia*. The question of tertiary ash lies entirely in the future.”

Impressed with these opinions Mr. Hills generously left by his will a considerable sum to the Royal Agricultural Society of England for the purpose of carrying out experiments on the value of “tertiary ash.” On his death, which took place in 1896, the bequest was handed over to the Society, and steps were at once taken to put into operation the wishes of the benefactor. I have already explained how it was that the establishment of a Pot-culture Station presented itself as the best way in which the terms of the bequest could be carried out. And if it be asked why, in the work of the Station, such subjects as those set out were selected, in preference to others that might suggest themselves, the answer is a simple one—

they were those which it was laid down in the terms of the bequest should be dealt with. It may prove to be the case that some of the constituents named are of such rare occurrence, and would be so expensive in application, even if found to be beneficial, as to put them out of court for practical use in agriculture; but still that does not do away with the obligation on the Society to put them, as the testator intended, to a thorough test, and on this basis I have proceeded with the experiments.

For the *first* year of experimentation, the subject being more or less of a novel character, I thought it well to try tentatively in some form *all* the constituents named by Mr. Hills. From this first year's experience I then intended to select for more thorough inquiry such of the constituents as seemed to show some marked effect, and then to devote myself to a more complete study of these.

The division of ash constituents into (a) primary, (b) secondary, (c) tertiary, had no relation, as some might suppose, to geological considerations; it was a purely arbitrary division according to order of believed importance. Respecting each of the tertiary constituents it may be observed preliminarily that—

1. Fluorine is known to exist in certain phosphates as fluoride of calcium.

2. Manganese constantly occurs in soils, but is not known to exercise any benefit, except so far as the experiments of Salm-Horstmar seemed to point to this. It has been proved, however, by water-culture, that manganese is not capable of replacing iron. For purposes of comparison compounds of iron were used, in the experiments now to be described, side by side with those of manganese.

3 and 4. Iodine and Bromine are constituents of sea-weed, but it is not known what their agricultural importance may be. Chlorine compounds were made use of in these experiments by way of comparison.

5. Titanium. Of this little is known, and it occurs in soils only in traces.

6. Lithia is found in plants, notably in tobacco. It has also—as shown in certain waters—a marked analogy to potash and soda.

In order to compare with fluorine used as calcium fluoride ( $\text{CaF}_2$ ), lime ( $\text{CaO}$ ) was taken. Elimination of the element calcium ( $\text{Ca}$ ) might, it was thought, show whether fluorine was advantageous or not. Similar comparisons were instituted in other cases. Inasmuch as some of the compounds were insoluble in water and others partly or quite soluble, the

comparison was not a strict one. It was thought well, however, to take up those compounds of the elements to be tried which were most readily obtainable, or which, if ultimately found of use, could be most cheaply purchased. It was necessary also to exclude as far as possible those which contained other manurial constituents which might complicate the result.

The materials used were :—Calcium fluoride ( $\text{CaF}_2$ ); calcium oxide ( $\text{CaO}$ ); manganese oxide ( $\text{Mn}_2\text{O}_3$ ); sodium iodide ( $\text{NaI}$ ); sodium bromide ( $\text{NaBr}$ ); sodium chloride ( $\text{NaCl}$ ); titanium oxide ( $\text{TiO}_2$ ); ferric oxide ( $\text{Fe}_2\text{O}_3$ ); lithium chloride ( $\text{LiCl}$ ); calcium chloride ( $\text{CaCl}_2$ ). These were all applied at the rate of 5 cwt. per acre.

The crops selected were wheat and barley as representing cereals, mustard as representing the Cruciferae, and peas and red clover as leguminous crops.

### I. Hills' Wheat. First year, 1898.

As the Station was only in regular working order by January 31, 1898, the season was already rather late for wheat sowing. The particulars of sowing were as follows :—

Variety sown . . . . .	"White-chaff Browick."
Soil . . . . .	From Stackyard Field, Woburn.
Number of seeds sown per pot .	15.
Date of sowing . . . . .	February 17, 1898.
Depth at which sown . . . .	About 1 inch.
Kind of pot used . . . . .	Earthenware.

The soil used was the same as that on which the continuous wheat and barley field experiments have been carried out since 1877. The quantity to be used for the whole series was well mixed up, sifted through a  $\frac{1}{2}$  in. sieve, and filled into the pots in successive layers of 8, 4, 4, 4, 4, 4, and 6 lb. (total 34 lb.), the bottom of the pot having first had gravel put over it to a depth of  $1\frac{1}{2}$  in. Each lot of soil was levelled and pressed down before the next was introduced. The manures when insoluble in water ( $\text{CaF}_2$ ,  $\text{CaO}$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{Fe}_2\text{O}_3$ ) were intimately mixed with the last lot (6 lb.) of soil and 4 oz. of water were added. The soluble manures ( $\text{NaI}$ ,  $\text{NaBr}$ ,  $\text{LiCl}$ ,  $\text{NaCl}$ ,  $\text{CaCl}_2$ ) were dissolved in 4 oz. of water and poured on the surface. The soil used was sampled for analysis, first the subsoil (first 24 lb.), then the top soil (final 10 lb.), the samples being dried and kept for reference.

Each separate experiment was in duplicate, and, counting two untreated pots, there were altogether 22 experimental pots used in this series. The actual weight of manure applied to

each pot, to give 5 cwt. per acre, was 3.2 grammes. The seeds used were weighed so as to get as nearly as possible the same weight, size, and kind of seed in each pot. They were put in just after the manures had been applied. In the first year's experiment the seed was not treated before sowing, but in subsequent ones it was steeped for 10 minutes in hot water at 133° F. This course should always be adopted.

Each pot accordingly started with the same quantity of water, and a record was kept of the water given at each subsequent date. About this it is only necessary to note the principal points of difference observed. Where sodium iodide (NaI) was given, the soil became crusted on the top and looked very parched. With sodium bromide (NaBr) a somewhat similar appearance, though less marked, was noted. It was also found generally that the amount of water required was a guide to the relative luxuriance of the plants.

[*Note.*—The details of filling the pots, mixing the manures, watering, &c., have been given fully in the case of the above experiment, and this will avoid the necessity of repetition subsequently.]

As regards the rate of germination—the seed was sown on February 17 and the first plants appeared on March 11. This was the case with all the applications except sodium iodide and lithium chloride. These distinctly retarded germination, the first plants only appearing on March 16 and 17. The full number of 15 (sometimes 14 only) in most cases had appeared by about March 22, but neither sodium iodide nor lithium chloride gave the full number. With sodium iodide, in one pot nothing appeared until March 23, and only 4 plants came up in all; in the duplicate pot the first plant appeared on March 16 and finally only 9 plants came instead of 15. With lithium chloride the first plants appeared on March 16, but only 10 in the one case and 11 in the other came up. It is worthy of note that sodium bromide exercised no retarding or destructive influence at this stage, the plants coming just as well as in any of the other cases.

It was noticed on March 19 that the soil of the two pots to which sodium iodide had been applied smelt distinctly of iodine, and that the soil was very impervious to water, owing to a regular crust forming on the surface. After March 29 the plants in these two pots began to die off. In one no plants were left at all, and the soil was accordingly turned out and the pot refilled with fresh soil on May 9, a weaker application—2 cwt. per acre—of sodium iodide being now used. In this the new plants came up quite well. Meantime only two plants were left

growing in the duplicate pot (5 cwt. per acre of sodium iodide). From this time to that of harvest there was comparatively little to note by way of difference between the variously treated pots, with the exception of those treated with sodium iodide, sodium bromide, and lithium chloride, and to these three reference will be practically confined.

About the middle of May the wheat was attacked by a fungus—a *torula*—which gave a great deal of trouble. If any pots could be selected for superior luxuriance it would be those to which chloride of sodium had been applied, and then those with manganese oxide. The heights of the crops were measured at intervals and notes taken of the general appearances, as well as photographs when it seemed desirable. This naturally involved a great deal of labour, much of which may be of no value in the end.

But, as regards the applications of iodine, bromine, and lithium the results were certainly striking.

With 5 cwt. per acre of sodium iodide all the plants died off except two; one of these was stunted, the other grew abnormally luxuriant. This luxuriance may of course have been due to the increased root development consequent on there being no other plants to dispute the area of growth. Where—after failure with 5 cwt.—the seeds were re-sown on May 9 with 2 cwt. per acre of sodium iodide all the plants grew well, but, owing to the late sowing, never came to ear.

With sodium bromide (5 cwt. per acre) everything went well until the middle of May, but then weakness and unhealthiness of crop began to show. All the plants began to droop and go off by June 28, the leaves turned brown more or less, and eventually only a few tiny ears were formed, the stalks being but 12 in. high as against 18 in. in other cases. Subsequent examination of the roots (see figs. 6 and 7, p. 572) seemed to show that, consequent on the use of sodium bromide, there had been, as it were, a check in the root growth and a formation of new roots from the root stock which then sent up a new shoot above ground. The corn produced was very shrivelled and the straw exceptionally weak. A comparison with fig. 7, where the plants were left untreated, will make this difference clear.

With lithium chloride the plants came up, as stated, slowly and in reduced numbers. At first they were considerably behind the others, but they went ahead again by the end of May and finished up nearly as good as the rest.

Fig. 8 (p. 573) shows the appearances of the crops treated with

Q Q 2

sodium iodide, bromide, and chloride respectively, and with lithium chloride.

The crops were harvested on Aug. 22, the straw being cut



FIG. 6.—Roots of wheat plant treated with sodium bromide, 5 cwt. per acre.

$\frac{1}{2}$  in. from the ground; the produce was left to dry for a fortnight, then put in a paper bag and hung up. The following spring the corn was beaten out by the hand, the number of

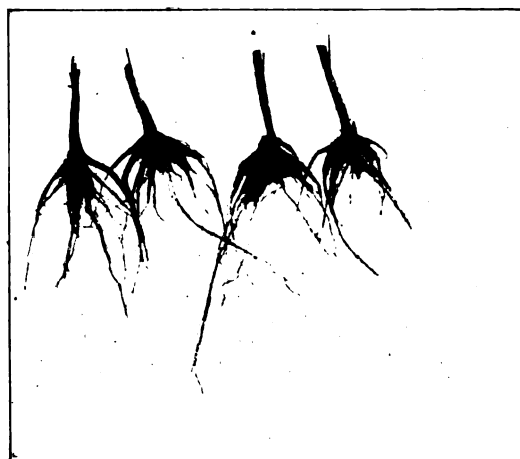


FIG. 7.—Roots of wheat plant, untreated.

grains counted and the corn and straw severally weighed, after which samples were taken and kept for reference.

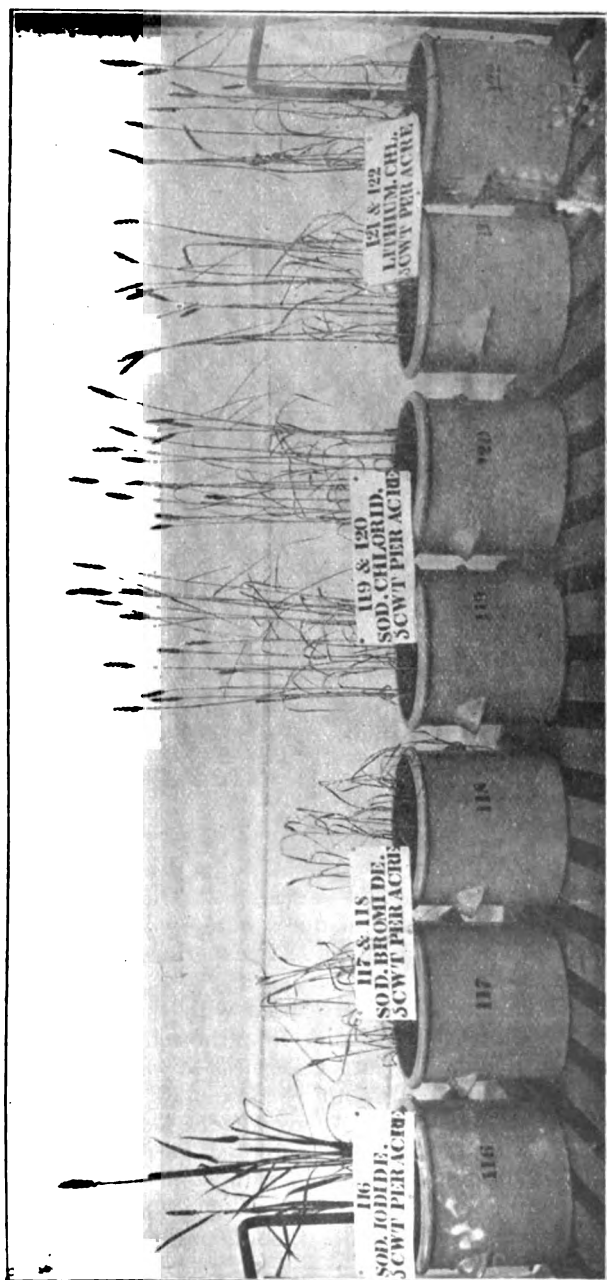


FIG. 8.—Wheat plant treated with (a) sodium iodide, (b) sodium bromide, (c) sodium chloride, (d) lithium chloride.

As regards the relative weights obtained per pot the only ones that need be selected for note are the following :—

Applications per acre	Weight of corn	Weight of straw
	grammes	grammes
Unmanured . . . . .	8.53	15.81
Sodium iodide, 5 cwt. . . . .	1.67	10.64
„ bromide, 5 cwt. . . . .	0.09	4.98
„ chloride, 5 cwt. . . . .	8.57	15.62
Lithium chloride, 5 cwt. . . . .	6.12	14.09

The general conclusions to be deduced from this experiment are :—

1. That sodium iodide applied—at the rate of 5 cwt. per acre—to wheat will kill the plant.
2. That sodium bromide—at the rate of 5 cwt. per acre—seems at first to do no harm to the wheat plant, but, later on, it affects it seriously, weakening the plant and reducing the yield. It seems also to check the growth of the roots and to cause the root stock to send out fresh roots.
3. That lithium chloride—5 cwt. per acre—has a retarding action at first upon the wheat plant, but that subsequently the plant grows and finishes fairly well.

## II. *Hills' Barley. First year, 1898.*

Variety sown . . . . .	“ Hallett's Pedigree.”
Soil . . . . .	From Stackyard Field, Woburn.
Number of seeds sown per pot . . . . .	15.
Date of sowing . . . . .	March 9, 1898.
Depth at which sown . . . . .	1 inch.
Kind of pot used . . . . .	Earthenware.

The details of filling the pots, mixing the manures, adding water, &c., were described in the case of the wheat experiments (pp. 569, 570). The same manures were used and in the same quantities, there being again 22 experimental pots under observation.

Much the same points were noted with the barley as with the wheat, *e.g.* the smell of iodine from the soil after application of sodium iodide, and the imperviousness to water.

Most of the plants came up by March 23, and all of them by March 30 or so, except where sodium iodide and lithium chloride had been applied, and here the germination was retarded. With sodium iodide the plants did not appear until March 30, and only 7 came up out of 15 seeds sown; with lithium chloride all came up, though rather later than the rest.

As with the wheat so here the only features to call for special remark are those attaching to the use of sodium iodide, sodium bromide, and lithium chloride, and the general results were similar to those with wheat.

Sodium iodide, at the rate of 5 cwt. per acre, killed all the plants except one, which grew abnormally strong. When, in place of the 5 cwt., re-sowing with 2 cwt. per acre of sodium iodide was done, all the plants came up, and, there being time for the crop to grow, it matured. Sodium bromide showed no

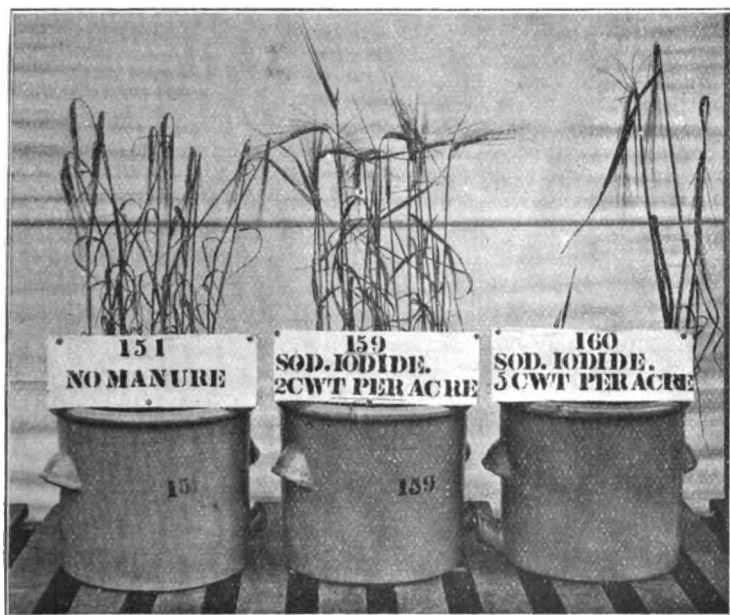


FIG. 9.—Barley plant treated with sodium iodide.

bad influence at first, but, later on, the crop became poor and the produce was small. Lithium chloride retarded the crop at first, but it subsequently grew fairly well and picked up. Figs. 9 (p. 575) and 10 (p. 576) illustrate the chief points brought out, fig. 9 showing the influence of sodium iodide in different quantities as compared with no treatment, and fig. 10 showing side by side the relative effects of sodium iodide, bromide, and chloride, with lithium chloride.

The barley was harvested on September 1, the crop dried, and then weighed. In spring 1899 the produce was beaten out

and the corn and straw weighed. There is nothing to be gained from these experiments further than has been already set out.

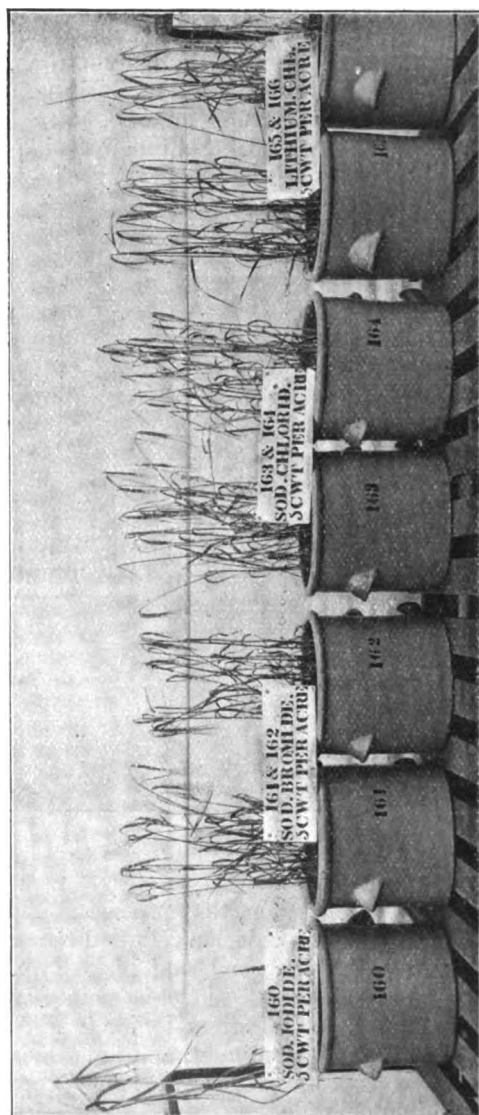


FIG. 10.—Barley plant treated with (a) sodium iodide, (b) sodium bromide, (c) sodium chloride, (d) lithium chloride.

III. *Hills' Mustard. First year, 1898.*

As a type of the Cruciferae mustard was taken. Twelve seeds of white mustard were planted in each of 22 earthenware pots on April 28, 1898, at the depth of  $\frac{1}{2}$  in. The same soil and applications were used as in the former experiments.

In the pots where sodium iodide and lithium chloride were used, not a single plant grew. With sodium bromide, on the other hand, the plants came quite well at first, but these became stunted later on, and remained poor throughout. On June 2 the growing plants were reduced by removal of superfluous ones to six in number in each pot. Re-sowing of one of each of the sodium iodide and lithium chloride pots was tried on July 2, no more of the materials, however, being used. In the former case a few plants appeared, but came to very little, and with lithium chloride absolutely none came up.

Of all the pots those to which lime (CaO) had been given did the best; on June 16 the height of these plants was 15.6 in., while the untreated ones measured 11.8 in. only. In view of the fact that charlock thrives best on soils rich in lime, the increase with the lime application is not to be wondered at.

The crop was harvested on August 3, the seed pods being picked off and the whole produce weighed.

The following results per pot may be of interest:—

Applications	Weight of seed reaped	Weight of straw
	grammes	grammes
Untreated. . . . .	2.91	7.44
Lime (CaO) . . . . .	2.39	7.36
Sodium iodide (after re-sowing)	1.50	4.75
„ bromide . . . . .	1.86	5.64
„ chloride . . . . .	2.28	8.44
Lithium chloride . . . . .	—	—

From this experiment it may be concluded—

1. That both sodium iodide and lithium chloride—at 5 cwt. per acre, the latter the more effectually—prevent the growth of mustard.
2. That sodium bromide in the end affects the mustard plant seriously, though at first there is no sign of injury.

IV. *Hills' Peas. First year, 1898.*

A similar experiment to the foregoing was tried with peas. The variety used was “Bedman's Imperial,” six seeds being sown in each of the 22 pots on March 2, 1898, at the depth of 1 in.

As between this crop and the preceding crops it was noticed that the peas required a much larger quantity of water than either wheat or barley.

With sodium iodide and lithium chloride, each at 5 cwt. per acre, not a single plant came up, and on re-sowing, without further application of the materials, one single plant, and that of stunted growth, came. One of the duplicate pots of each was turned out, refilled with soil, and only 2 cwt. per acre of sodium iodide and lithium chloride applied. In each case the plants came and grew on fairly to the end.

With sodium bromide, 5 cwt. per acre, the plants at first grew quite well, but then they began to burn up from the bottom; the lower leaves turned yellow and looked as if they had been scorched from the base. In this experiment, as distinguished from the others, chloride of sodium, though doing well enough at first, proved eventually to be harmful, the leaves turning a light sickly colour. That the sodium iodide and lithium chloride had really destroyed the germinating power of the seeds was proved by digging them up where the plants had not come, and planting them then in flower pots with untreated soil, when again they did not come up. They appeared to have in some cases germinated and then the growth to have been arrested and the seed rotted away.

When the plants had grown sufficiently high they were allowed to climb up sticks placed round the interior of the pots and fastened with string. The most luxuriant plants seemed to be those treated with oxide of iron or with calcium chloride, the former having the better colour.

On August 29 the crop was harvested, and weighed on September 2. As regards the weights, the following figures will be of interest:—

Applications per acre	Weight of peas	Weight of straw
	grammes	grammes
Untreated . . . . .	11·8	14·13
Sodium iodide, 5 cwt. . . . .	—	—
"    "    2 cwt. . . . .	15·5	14·97
"    bromide, 5 cwt. . . . .	6·64	17·46
"    chloride, 5 cwt. . . . .	5·15	11·72
Lithium chloride, 2 cwt. . . . .	13·0	16·54

The general conclusions as regards peas were:—

1. That sodium chloride and sodium bromide, at the rate of 5 cwt. per acre, injure the pea plants eventually, though at first they seem harmless.
2. That sodium iodide and lithium chloride, at the rate

of 5 cwt. per acre, prevent the pea seed from germinating properly.

3. That sodium iodide and lithium chloride, at the rate of 2 cwt. per acre, do not harm the pea plant, but effect a small improvement.

*V. Hills' Clover. First year, 1898.*

Broad red clover was tried similarly to the foregoing crops. Zinc pots, coated inside with pitch, were, however, used instead of the earthenware ones. Twelve seeds were sown on May 16, 1898, at a depth of  $\frac{1}{2}$  in. in each of the 22 pots. Very much more water was required than with any of the other crops. After the plants had come up the number was reduced to six in each pot. The only deviation from the plan of treatment described was that, as 5 cwt. per acre of sodium iodide and lithium chloride had seemed too heavy an application for the other crops, these materials were now applied at the rate of 2 cwt. per acre only.

Here in every case except that of the application of lithium chloride the plants came up. The treatment with sodium iodide (2 cwt. per acre) did not affect the plants injuriously, and the plants were apparently more luxuriant than elsewhere. Those with sodium chloride were very good, and also those with sodium bromide. These observations, however, were not borne out in the following year, and, for that reason, not much stress is put upon the present results. Though seeds were re-sown in the lithium chloride pots, they did not come up.

The first crop was cut on August 27, the second on November 1, 1898. The plants were left on through the winter, and the first cutting of the second year's crop was taken on June 27, 1899, and the second cutting on August 19, 1899.

It cannot, however, be said that the duplicates agreed among themselves, and it is not well, therefore, to draw conclusions beyond saying that lithium chloride, even at the rate of 2 cwt. per acre, prevented the proper growth of the red clover, while sodium iodide (2 cwt.) and sodium bromide (5 cwt.) did not this year have the harmful effects noted with the cereal crops.

This concluded the first year's experiments under the Hills Bequest.

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Tentative experiments having thus been tried with the different materials specified, it was resolved in the second year's series to select for further and more complete trial those materials which had so far shown the most marked indications of exercising influence upon crops.

These were iodine and bromine in particular. Inasmuch, too, as something seemed to turn upon the quantities in which the compounds of these elements were used, it was decided to try them in varying quantities and applied at different periods. Some experiments were also instituted in soaking, in dilute solutions of the salts, the seed to be sown.

#### VI. *Hills' Wheat. Second year, 1899.*

The wheat was this time sown at the proper date; also all seed used was, previous to sowing, soaked in hot water for ten minutes.

A preliminary experiment was made in order to ascertain whether the seed would bear soaking in solutions of iodine and bromine salts without losing its germinating power.

It was found that even a 10 per cent. solution of these salts in contact with the seeds for ten minutes would not kill them. A 1 per cent. solution was, however, employed.

For the wheat experiments of this, the second, year the variety sown was, as before, 'White-chaff Browick,' but steeped in hot water before planting to a depth of 1 in.; also twelve seeds only, instead of fifteen as before, were sown, and the number of plants was subsequently reduced to six in each pot. The dates of sowing were December 9 and 10, 1899, the same kind of soil (from Stackyard Field) being used as in 1898, only in the meantime two crops of mustard, each of which was removed, had been grown on it while lying in the pit in which it was stored. Thirty-three pots were devoted to this experiment, each treatment being in triplicate.

The general plan of experiment was to grow wheat treated with sodium iodide and sodium bromide at the rates of 2 cwt. and 1 cwt. per acre respectively, and also to use seed soaked in 1 per cent. solutions of these salts. The salts when used direct were dissolved in 150 c.c. (cubic centimetres) of water, the same quantity of water being added to all the other pots. Further, it was intended to try the difference between the above salts applied direct to the soil at the time of sowing and used as a top-dressing later on.



The pots containing seed soaked in sodium iodide, though at first they did not look good, afterwards became the most

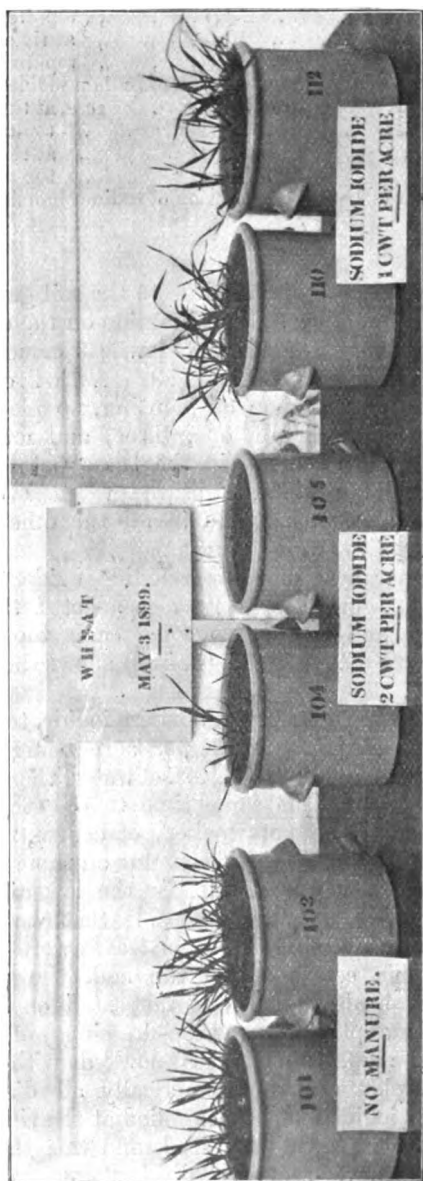


FIG. 11.—Wheat plant treated with sodium iodide—(a) 2 cwt. per acre, (b) 1 cwt. per acre. Appearances on May 3, 1899

luxuriant. Whereas in the other pots the lower leaves mostly died off, they did not in these. The corn also tillered out very well, and perhaps better than in any other cases. Fig. 12

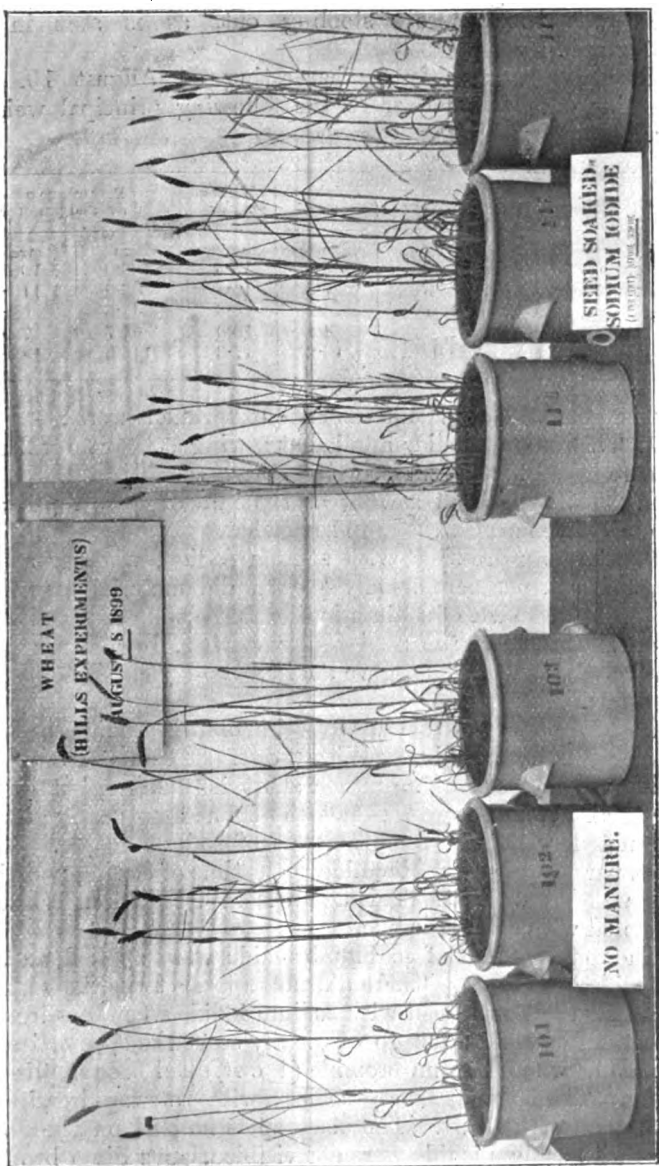


FIG. 12.—Wheat seed soaked in 1 per cent. solution of sodium iodide before sowing.

shows the appearance of these pots on August 8, 1899, as compared with the untreated ones. It was noted especially that the straw, though not as high as that of the untreated pots, had a larger number of stalks, and hence more ears. There was thus more "stooling out," as is seen in the photograph.

The crop was ready for harvesting on August 10. On threshing out on December 13 the following principal weights were obtained :—

Applications per acre	Weight of corn	Weight of straw	Percentage of untreated produce	
	grammes	grammes	corn	straw
Untreated.	8.8	13.3	100.0	100.0
Sodium iodide, 1 cwt. at sowing	7.8	15.7	88.9	118.2
" " 1 " top-dressed	4.2	8.8	47.6	66.5
" " $\frac{1}{2}$ " "	4.8	10.0	54.7	75.7
" " seed soaked	10.2	17.3	116.5	130.1

The general conclusions from the experiment were :—

1. That sodium iodide applied at sowing at the rate of 2 cwt. per acre killed the wheat crop altogether.
2. That applied at sowing at the rate of 1 cwt. per acre sodium iodide harmed the crop somewhat.
3. That top-dressing with sodium iodide, whether at the rate of 1 cwt. per acre or only  $\frac{1}{2}$  cwt., did material harm, and more so than 1 cwt. of sodium iodide at the time of planting.
4. That soaking the seed before sowing, in a 1 per cent. solution of sodium iodide, gave an increased yield of both corn and straw.

To turn now to the similar experiments with sodium bromide in place of sodium iodide. With 2 cwt. per acre at the time of sowing the plants came up rather short in number, but looked fairly healthy, and there was not the immediate destruction of crop noted with the same amount of sodium iodide. With 1 cwt. per acre of sodium bromide at the time of sowing no injury at all was done at first. This again is rather different to what was noted with sodium iodide.

The top-dressings of sodium bromide were applied, as with the iodide, on May 1. There did not appear to be the marked effect that there had been with sodium iodide when top-dressed, the bottom leaves did not go off nearly so markedly, nor indeed as much as where sodium bromide (1 cwt.) had been applied at sowing. The harmful effect was less with the top-dressing of  $\frac{1}{2}$  cwt. than with 1 cwt. The black spots noticed on the lower leaves with sodium iodide were not visible when sodium bromide

was used, but it was remarked how very brittle and weak the straw was, the stalks being hardly able to stand, and being broken by the wind when other pots did not suffer at all. With the seed soaked in a 1 per cent. solution of sodium bromide there was no check experienced, nor did the lower leaves "go off" at all; the crop looked throughout quite as well as, or better than, the untreated one. Here, as with sodium iodide, though hardly as markedly, more ears were produced, and there was more "stooling out." The figures at harvest were:—

Applications per acre	Weight of corn	Weight of straw	Percentage of untreated produce	
	grammes	grammes	corn	straw
Untreated . . . . .	8.8	13.3	100.0	100.0
Sodium bromide, 2 cwt. at sowing .	2.0	8.4	23.1	63.4
" " 1 " " " "	2.8	8.3	32.3	62.7
" " 1 " top-dressed	4.1	11.0	47.2	83.0
" " ½ " " "	4.8	10.9	54.4	82.5
" " seed soaked	9.5	14.6	108.7	110.0

These results show:—

1. That sodium bromide, whether applied at the time of sowing or top-dressed later on, has a harmful effect on wheat, the evil being greater with the direct application at sowing and with the greater quantity used.

2. That soaking the seed in a 1 per cent. solution of sodium bromide has a beneficial effect.

*Supplementary Experiment (Water-culture).*—The above results, as regards iodine especially, being of a somewhat striking nature, it was sought to ascertain what effect, if any, traces of sodium iodide had on the root-development of wheat.

Four wheat plants about seven days old (after being germinated from seed on blotting-paper) were put into clear glass jars containing a normal solution made up of the following nutrient materials:—

	Grammes
Calcium carbonate . . . . .	28.50
Magnesium carbonate . . . . .	3.0
Potassium phosphate . . . . .	17.2
" sulphate . . . . .	13.05
" chloride . . . . .	25.75
Sodium chloride . . . . .	14.4
Nitric acid ( $N_2O_5$ ) . . . . .	53.0
Sulphate of iron . . . . .	1.0

<sup>1</sup> Added subsequently.

with 2 litres of distilled water.

Of this solution 100 c.c. were taken and diluted to 5 litres

with distilled water. The culture liquid was changed about every week, and filled up with water as necessary. In this the wheat plants were placed on June 15, one in each of four jars. On July 8 to two of the jars 0.1 grm. of sodium iodide dissolved in  $2\frac{1}{2}$  litres of the culture solution were added (making 1 part of iodine in 43,700 of solution), the other two jars having the nutritive solution only.

By July 21 the root development where iodine was present had become quite dwarfed, and the photograph taken on that day (fig. 13, p. 587) brings out this point very clearly.

Subsequently the plants were taken out, the roots washed, dried, and weighed.

Weight of whole plant with roots (air dried) :—

					Grammes
Without iodine	.	.	.	.	0.277
With	„	.	.	.	0.141

From these experiments, made in two successive years, it is clear that both sodium iodide and sodium bromide, when used in quantities even as low as  $\frac{1}{2}$  cwt. per acre, exercise a hurtful influence upon the wheat plant, whether applied to the soil direct at the time of sowing or top-dressed later on, and that they seem to check the root development. On the other hand, soaking of the seed, before sowing, in a 1 per cent. solution of either salt exercises a good influence upon the wheat plant, giving a stimulus to its growth, and results in increased yield.

This subject is being further pursued at the Pot-culture Station.

#### VII. *Hills' Barley. Second year, 1899.*

This series is a counterpart of those just described in the case of wheat, and the details of procedure, applications made, &c., being the same, it will be enough to note generally the differences shown and the conclusions come to.

An additional feature was that not only were the applications of sodium iodide and sodium bromide made *at the time* of sowing, but these salts were also applied some time *before* sowing, in order to see whether the salts would possibly be removed sufficiently from the top surface to allow of the plants making a good start.

The seed was sown on April 11 and 12, 1899, twelve seeds per pot, and the plants subsequently reduced to six per pot. The early applications (before sowing) of sodium iodide and sodium bromide—each at the rate of 2 cwt. and also of 1 cwt. per acre—

were made on February 23. The experiments being in triplicate there were 45 pots in all (earthenware).

(a) *Sodium Iodide*.—Previous treatment (February 23) with

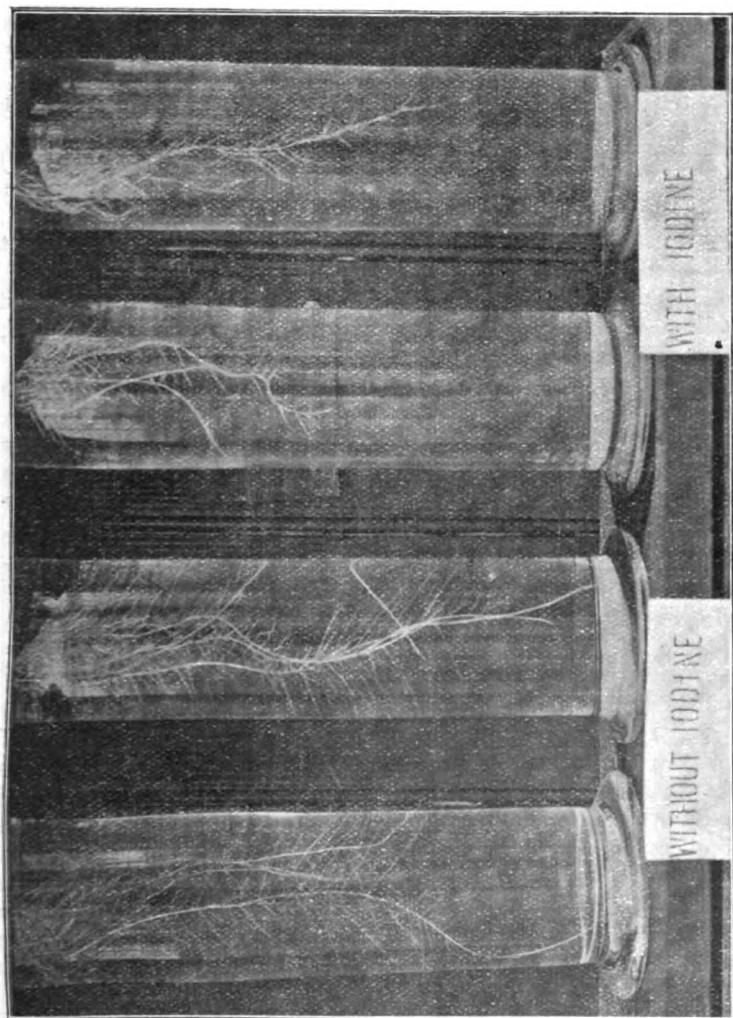


FIG. 13.—The influence of iodine on the development of the roots of the wheat plant.

2 cwt. of sodium iodide did not show any harmful effect until July 25, all the plants coming up well, but about that date the ears were noticed to be short, and the plants not as tall as on the untreated pots.

Previous treatment with 1 cwt. of sodium iodide showed similar results, though not so marked.

Very probably the sodium iodide had in these cases gone to the bottom of the pot, and it was only later on that the roots reached it.

With 2 cwt. of sodium iodide at the time of sowing the plants did not come at all.

With 1 cwt. similarly applied the plants came, but were rather short in number and growth.

With 1 cwt. of sodium iodide as a top-dressing (June 21) the plants began to turn yellow in the lower leaves three days after the application.

With  $\frac{1}{2}$  cwt. top-dressed, the plants also turned yellow, but not so markedly as when 1 cwt was used.

Soaking the seed, before sowing, in a 1 per cent. solution of sodium iodide had the effect of giving a more luxuriant growth than on the untreated pots.

(b) *Sodium Bromide*.—The general effects of treatment with sodium bromide were not as marked as with sodium iodide. The one exception was that of the seed soaking. Here the effect of soaking the seed, before sowing, in a 1 per cent. solution of sodium bromide was to give a better crop, as shown by the harvest results, as follows:—

Application	Weight of corn	Weight of straw	Percentage of untreated produce	
	grammes	grammes	corn	straw
Untreated . . . . .	8.9	8.8	100.0	100.0
Seed soaked in sodium bromide (1 per cent) . . . . .	10.1	10.5	113.8	119.6

As regards the barley plant, much the same may be said as about the wheat plant—that applications of sodium iodide and sodium bromide, whether before, or at the time of sowing, or as top-dressings later, affect the crop injuriously. The harmful influence of sodium bromide does not, however, appear to be as marked with barley as with wheat. Soaking of the seed in a 1 per cent. solution, before sowing, of either sodium iodide or sodium bromide, on the other hand, produces with barley, as with wheat, some increase of yield.

#### VIII. *Hills' Clover. Second year, 1899.*

Under this heading, the first matter to deal with is the clover sown in 1898, and now going on for a second year. As observed on p. 579, in 1898 the best crops were obtained with

sodium iodide (2 cwt. per acre), sodium chloride (2 cwt.), and sodium bromide (2 cwt.), while lithium chloride (2 cwt. per acre) prevented the growth altogether, although the seeds were re-sown.

During the winter the frosts spoiled the clover plant a good deal. In the early summer mildew also made its appearance.

The produce of 1899 was reaped on June 27, 1899, and the second cutting on August 19, 1899. In the joint produce the best crop was obtained from sodium iodide (2 cwt. per acre), while sodium chloride (5 cwt. per acre) and sodium bromide (5 cwt. per acre) gave the next highest yields. Lithium chloride, as stated, had already destroyed the crop altogether, although only used at the rate of 2 cwt. per acre.

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In 1899 a fresh series was begun—also on broad red clover. Twelve seeds were sown in each pot on May 15, 1899, to be reduced subsequently to six plants in each pot.

Experiments were again in triplicate, the plan followed being similar to that of the barley just described, with the modification that the application of sodium iodide and sodium bromide before sowing was not adopted, and, in place of it, not only 2 cwt. and 1 cwt. of these salts were used at the time of sowing and as top-dressings, but also the salts at the rate of  $\frac{1}{2}$  cwt. per acre.

(a) *Sodium Iodide*.—When 2 cwt. of sodium iodide was used at the time of sowing only one or two plants came up, and these all soon died off.

With 1 cwt. similarly used a few more plants came, and they too afterwards died.

With  $\frac{1}{2}$  cwt. still more plants appeared, but some of them died after a time.

The salt was applied as a top-dressing on July 26. Almost as soon as the 2 cwt. per acre went on, the leaves were turned brown, and in a short time all the plants died.

With 1 cwt. top-dressed, the plants did not go off so quickly, and a few remained to the following year (1900) as stunted plants.

With  $\frac{1}{2}$  cwt., also top-dressed, the plants were not much injured, and the crop was not much less than the untreated one. Still the application did no good.

Lastly, the soaking of the seed in a 1 per cent. solution of sodium iodide seemed to result in a slight increase of crop.

It will be noticed that these results as regards the use of

2 cwt. per acre of sodium iodide were contrary to those obtained the year before, as in 1898 this application did well, whereas in 1899 it killed the crop. The exact truth remains therefore somewhat uncertain, though, considering all points, the experiments of the second year (1899) should be the more reliable.

(b) *Sodium Bromide*.—The results were similar to, though not so marked as, those with sodium iodide.

Two cwt. per acre at the time of sowing did not kill the clover plants, but it materially reduced the yield. One cwt. per acre also reduced it, though to a lesser degree, and  $\frac{1}{2}$  cwt. per acre gave only a slight reduction of yield. Top-dressing (on July 26) gave no benefit, though it did not seem to harm the crop.

Soaking of the seed, before sowing, in a 1 per cent. solution of sodium bromide, as with sodium iodide, slightly increased the yield.

The general conclusion as regards the results of the two years' experiments on red clover must be taken as being:—

1. That, as with cereal crops, so with clover, sodium iodide used at the rate of 2 cwt. per acre is fatal to the plants, while sodium bromide at a similar rate, though not so marked in its effects, does some harm.

2. That neither sodium iodide nor sodium bromide in lesser quantity than 2 cwt. per acre, whether applied at the time of sowing or as a top-dressing, is productive of good, but rather of harm.

3. That soaking the seed, before sowing, in a 1 per cent. solution of either sodium iodide or sodium bromide is productive of some benefit to the crop.

### IX. *Hills' Mangels*, 1899.

The attempt was made to experiment with mangels in much the same way as with the crops already described. This was, however, found impracticable with pots of the size in use at Woburn, for it was not possible to have more than one full-grown root in each pot, and the differences between duplicates were too great for fair deductions to be drawn.

So far as they went, the experiments pointed to the conclusions that sodium iodide—at the rate of 1 cwt. per acre—whether applied at the time of sowing or as a top-dressing was decidedly injurious; that sodium bromide—put on at the rate of either 2 cwt. or 1 cwt. per acre—at the time of sowing, was also injurious, but when used as a top-dressing did not injure the

crop any more than the same amount of chloride of sodium used as a top-dressing.

This concludes the second year's (1899) experiments under the Hills Bequest.

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## B. MISCELLANEOUS POT-CULTURE EXPERIMENTS.

While the Pot-culture Station at Woburn was instituted primarily for the purpose of carrying out the experiments under the Hills Bequest, it was felt that if other matters of inquiry could be carried out as well, interesting results might follow. A start was accordingly made in 1898 with other experiments bearing on agricultural questions.

The first of these was on :—

### I. *Thick v. Thin Sowing of Wheat.*

It has been somewhat open to question how far the thick or the thin sowing of wheat and barley affects the growth of the crop and the ultimate yield. No doubt differences of soil and locality will have a bearing, so also will the consideration as to whether a fine quality rather than total produce is sought after. The general idea may be stated as being that wheat sown thinly rather than thickly is the better, and tillers out more, while with barley the thicker sowing is to be preferred. It must be remembered, moreover, that in actual practice in sowing corn one has to allow for what may be lost by burying too deep, by lying on the surface, by depredations of birds or insects, and other disturbing causes which in pot-culture are under control. It seemed, however, desirable to try by methods of pot-culture to get at actual facts and figures.

Owing to the late inception of the Pot-culture Station, wheat could not be sown until February 23, 1898. "White-chaff Browick" was used, the seeds being as nearly alike as possible in regard to size, kind, and weight; the soil used was that of one of the fields of the Woburn farm where swedes had, during the winter, been fed off by sheep with cake.

Zinc pots were employed, and each experiment was in duplicate, the plan being as follows :—

- a. 2 pots each sown with 20 wheat seeds, corresponding to a seeding of 12 pecks per acre.
- b. 2 pots each sown with 15 wheat seeds, corresponding to a seeding of 8·3 pecks per acre.
- c. 2 pots each sown with 10 wheat seeds, corresponding to a seeding of 5·5 pecks per acre.
- d. 2 pots each sown with 5 wheat seeds, corresponding to a seeding of 2·7 pecks per acre.

Practically all the plants came up in each case. By May 4 a considerable difference was noticeable in respect of the number of shoots coming off from each plant, the thin seeding showing the most and the thick seeding the least, with regular gradation between these extremes. Taking the average of the two pots, there were 6.1 shoots per plant with the thin seeding, and 3.5 only with the thick, the others coming intermediately.

On June 6 the shoots were again counted, the differences being still more striking, viz. 7 shoots per plant with the thin seeding against 2.6 with the thick.

Measurement of the height of the plants and length of ear on July 14 showed marked differences:—

	Thin seeding in.	Thick seeding in.
Height of plant . . . .	20.6	13.7
Length of ear . . . . .	2.7	1.9

These appearances are well brought out in fig. 14 (p. 593), a regular gradation being noticed in the height of the plants between the thickest seeding (left hand of picture) and the thinnest (right hand of picture).

The thinly-sown sets gave much the more sturdy shoots and stronger straw, and the wheat had tillered out very much better in these.

The crop was cut on September 1, and when the respective yields were weighed it was found that the number of grains per pot was much the same in all cases, but, taking the yield of corn per plant, this was greatly increased in the thin seeding. The results came out as follows:—

No of seeds sown per pot	Equivalent seeding per acre	Weight of corn	Weight of straw	Yield per plant	
				Corn	Straw
	pecks	grammes	grammes	grammes	grammes
5	2.7	5.6	11.3	1.11	2.27
10	5.5	5.9	11.4	0.59	1.14
15	8.3	4.9	10.6	0.31	0.73
20	12.0	4.8	11.2	0.24	0.57

This table shows that, on the whole, the wheat did best when 10 seeds per pot were sown. This would be equivalent to a seeding of 5.5 pecks per acre. In practice, however, it would be necessary to allow for depredation by birds, insects, &c. and other causes of loss, so that one might say that, on a light loam such as that of the Woburn farm, about 7 pecks per acre would be the right quantity to sow.

Incidentally this experiment shows that, as regards pot-

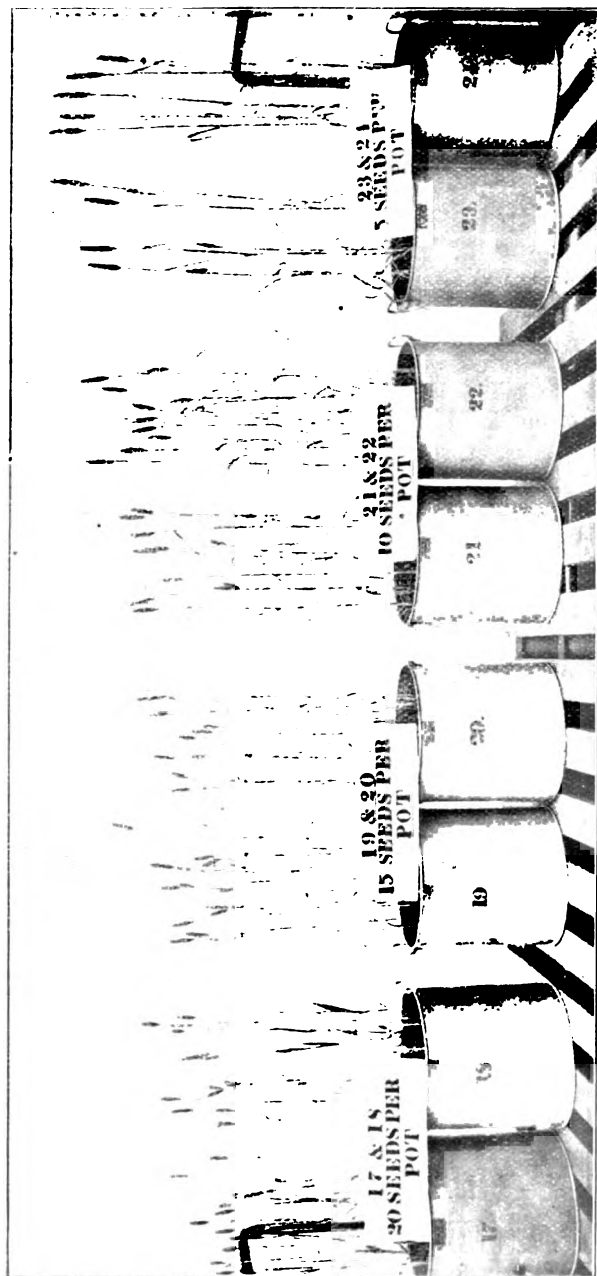


FIG. 14.—Thick and thin sowing of wheat 1898. Appearances on July 14, 1898.

culture growing, it does not matter much what quantity of seed is sown per pot, the total yield being much the same; the smaller number of plants means more luxuriance, but the results are comparable *inter se* if the same way of seeding be adopted throughout.

After the corn and straw had been removed, the roots were dug up, carefully washed and dried, then photographed. Figure 15 (p. 595) shows very clearly how with the thin seeding the roots have had ample room to grow out and develop strongly, whereas with the thick seeding they have been cramped in the struggle, and only thin weak roots and stems have been developed in consequence.

*Second Year's Experiment, 1899.*—The foregoing experiment was repeated in 1898-99, as the striking differences just described were obtained with *spring*-sown corn.

This fresh year the wheat could be sown at the right time—December 15, 1898 being the date of sowing. The number of seeds sown and general arrangement was the same as before.

In February 1899 there was no apparent difference between the several pots, and not until April 29 did the same variations that had been before noticed show themselves. The plants from the thinnest seeding then came to look decidedly the biggest and strongest, and they remained the healthiest throughout, while the thick seeding again gave the smallest plants. The differences generally were not nearly as marked as in the previous year. Fig. 16 (p. 596) shows clearly, however, the superiority of the seeding of ten and fifteen seeds per pot to that of twenty seeds per pot. The duplicate pots did not give as good agreement as could be wished in regard to produce of corn and straw, and the figures are hence omitted.

## II. *Thick v. Thin Sowing of Barley.*

Experiments similar to the foregoing with wheat have been carried out in two successive years with barley, but, from one cause and another, in neither case did the experiment proceed satisfactorily, and the question must be further tried later on. So far as the experiments went, the general indication was that with barley the thick seeding did quite as well as the thin, and the differences alluded to in the case of wheat were not here apparent.

## III. *Large and Small Seed in Sowing (Wheat).*

The question has often been asked whether, in selecting wheat and barley for seed purposes, one ought to pick out the

largest and plumpest corns or not. An experiment on this point was tried in 1898 at the Pot-culture Station. Eight zinc pots were filled with soil from one of the farm fields; in

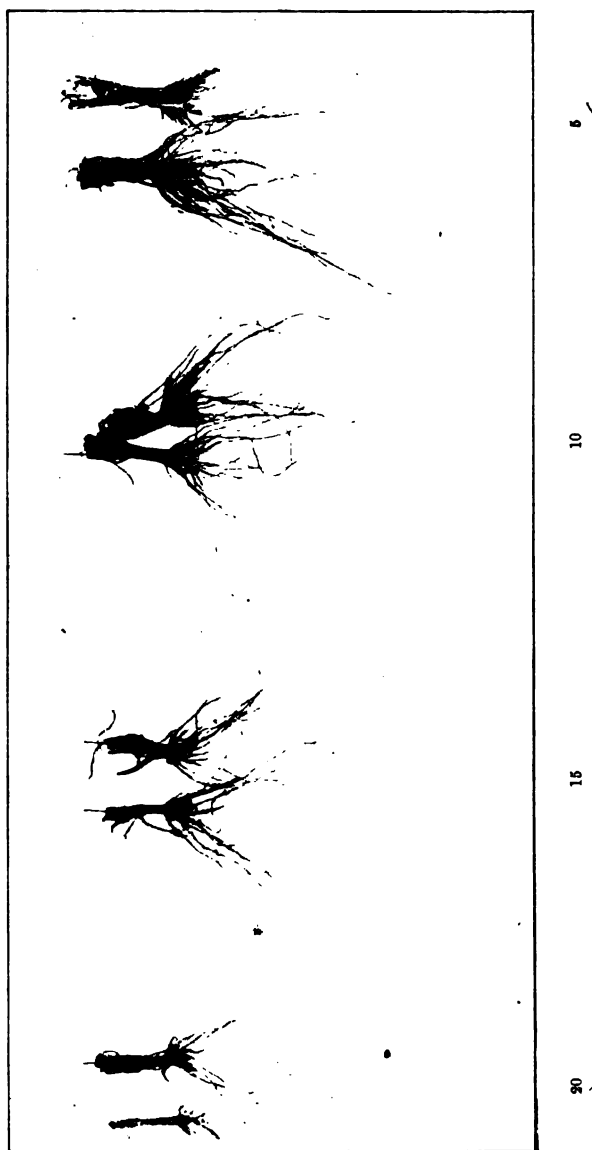


FIG. 15.—Thick and thin sowing of wheat, 1898. Appearances of the roots after harvest.

four of them was sown wheat seed the grains of which had been selected out of one lot of corn purposely because of their

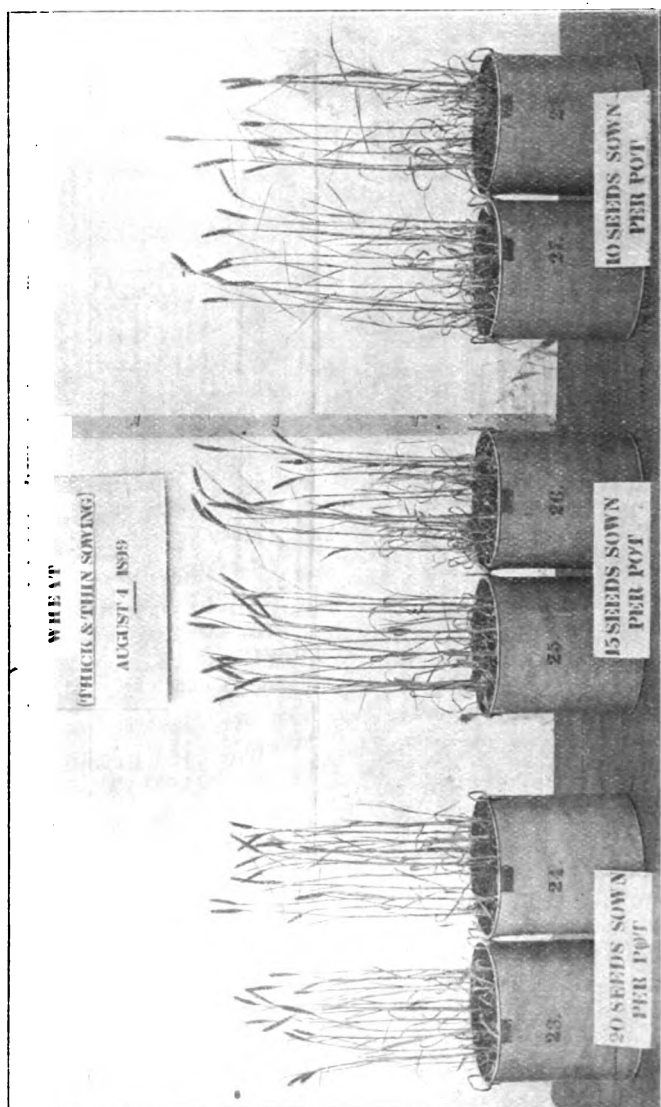


FIG. 16.—Thick and thin sowing of Wheat, 1899. Appearances on August 4, 1899.

being large in size. In the other four pots grains were sown selected from the same lot because of their smallness. The

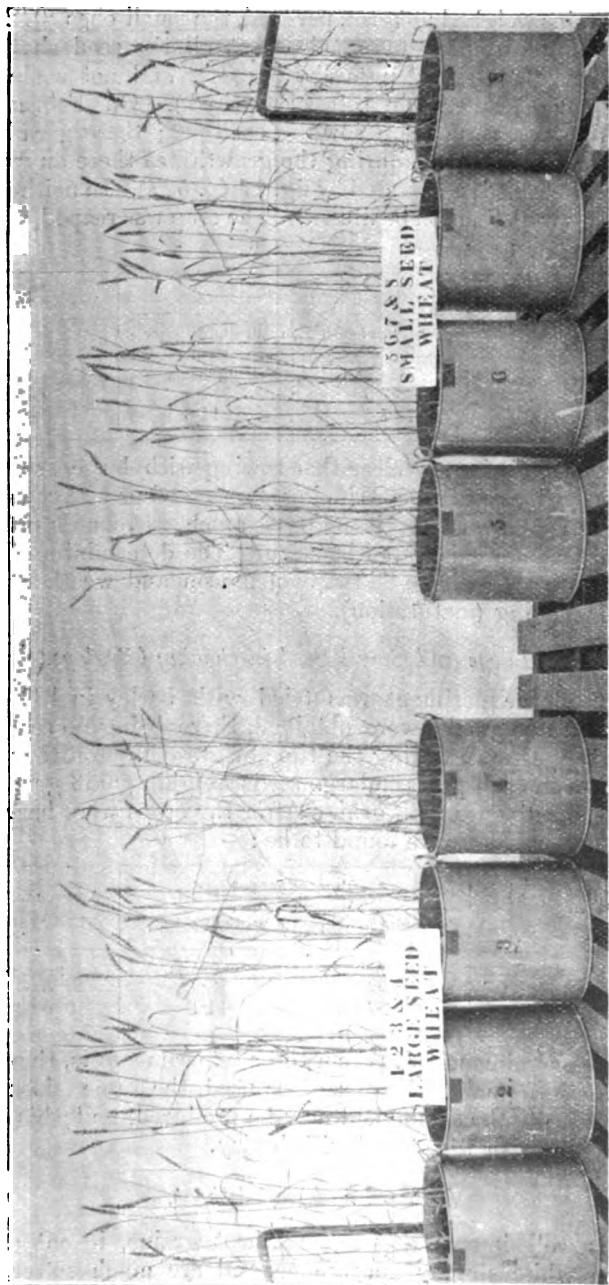


FIG. 17.—Sowing of large and small seed for wheat, 1898.

large grains weighed .06 grm. per seed, the small ones .042 grm. only. Care had been taken also that all the seed should be of the same sort, viz. "starchy" seeds, and not some hard ("glutinous") and some soft ("starchy"). On February 8, 1898, fourteen seeds were sown in each pot; these germinated equally, and at no time during the growth was there any visible difference. This is illustrated by fig. 17 (p. 597). In neither case could a clear distinction be drawn. The crop was reaped, and the average results were:—

	Produce per pot		Average weight of seed produced
	Weight of corn	Weight of straw	
	grammes	grammes	grammes
Large seed . . .	7.5	14.9	0.034
Small seed . . .	7.4	14.8	0.033

From this it is very clear that sowing with large seed does not necessarily result in producing large seed or *vice versa*, and it would not seem that it matters much, as regards produce, whether large or small seed be sown. The determining factors are much more likely to be those of season and weather at the time of ripening (maturation).

#### IV. *Large and Small Seed in Sowing (Barley).*

A similar experiment was tried with barley in 1898, and much the same results were obtained, there being no real difference of appearance during the time of growth. Fourteen seeds were sown in each pot, the large seeds weighing .053 grm. each and the small ones .032 grm. After the crops were harvested the average results were found to be:—

	Produce per pot		Average weight of seed produced
	Weight of corn	Weight of straw	
	grammes	grammes	grammes
Large seed . . .	12.37	13.9	0.042
Small seed . . .	11.75	14.4	0.041

The general conclusion from these experiments is, therefore, that, whether small or large seed be used, the same sized seed and practically the same yield may be produced, and this is the case equally with wheat and with barley.

#### V. *Hard and Soft Wheat.*

It is well known that some wheat grains, if cut across, exhibit a white starchy appearance, and are much softer than

others which are called by distinction "hard" wheat, and which, on cutting them across, have a semi-transparent or glutinous appearance, being much denser than the "soft" wheat. These latter qualities determine what is called "strength" in wheat, and, according to the various—and, it may be added, varying—demands of the miller, the introduction of special machinery for dealing with the grain, and the "fancy" of the time, so it becomes a question whether a grower should aim at getting "hard" wheat or "soft" wheat, or "glutinous" or "starchy" wheat, as the two kinds might otherwise be termed. The consideration of the influences bearing upon the production of one or the other hence assumes importance, and it was with the view of throwing some light upon this subject that the following experiments were devised. The first questions that suggested themselves for solution were: Does the sowing of soft wheat produce in its turn soft grain and that of hard wheat hard grain, or may one or the other, or both, be produced indifferently? Does the one ear contain only starchy grain or else only glutinous grain, or may the two kinds be grown on the same ear, and, if so, is one kind borne on one part of the ear and the other on another part? There are numerous other questions that might be suggested, such as the influence of soil, of manuring, of season, of ripening, &c., but a beginning was made with the foregoing.

The experiment was first started in 1898, but, through an accident, some birds got into the wire enclosure, and this wheat crop being well in advance of the rest, the birds cleared it off entirely in a single night. The experiment was therefore repeated in the following year (1899).

As it has been said that heavy land tends to produce a strong wheat and light land a more starchy grain, two different kinds of soil were used, the one the light sandy loam of the Woburn farm, the other a heavy, dark-coloured loam.

The same variety of wheat—"White-chaff Browick"—was sown in each case, there being 12 pots in all used, 3 for the "hard" and 3 for the "soft" wheat with either soil. The seeds were selected very carefully by hand, all the seed having been grown under the same conditions. It may be said that there is no difficulty—after a little experience—in picking out the grains that are "glutinous" and those that are "starchy." The seeds were weighed and arranged so that as nearly as possible the same weight of seed should be sown in each pot.

The plants came up evenly, and, after a time, were thinned

down to 6 plants in each pot. There was no real difference in time of germination; if anything, the glutinous seeds came up rather the quicker. The two sets grew evenly throughout, the heights of the plants being much the same. The crop on the sandy soil was ready first, it being harvested on August 4, while that on the heavy land was cut on August 11. The following table gives the results:—

Soil	Kind of wheat	Average per pot			Percentage of	
		No. of grains	Weight of corn	Weight of straw	Starchy grains	Glutinous grains
			grammes	grammes		
Light land	Soft	188	7.85	12.81	4.1	81.5
" "	Hard	181	7.27	10.71	5.1	83.2
Heavy land	Soft	222	8.89	12.87	—	100.0
" "	Hard	216	8.32	12.48	—	99.8

<sup>1</sup> The totals do not in all cases add up to 100, as there were some grains that could not be strictly classified.

This experiment shows that the sowing of "soft" wheat does not result by any means necessarily in the production of a starchy wheat, nor, on the other hand, that if "hard" wheat be sown the produce must be all glutinous grain. On the contrary, it shows that there must be determining factors of a much more powerful character—such, probably, as season and weather at time of ripening—than that of seed sown.

It indicates, however, that a heavy soil tends to give a more glutinous produce than a light sandy soil; and it will be observed that on the heavy soil, though nothing but "soft" wheat was sown, the produce was entirely "hard" wheat.

As determining whether the "hard" wheat was more nitrogenous and the "soft" wheat less so, analyses of the grain were made, and gave:—

	Hard Wheat per cent.	Soft Wheat per cent.
Moisture . . . . .	17.82	17.90
Nitrogen (on the dry grain) . . . . .	2.57	1.94

Thus the "hard" wheat was considerably the richer in nitrogen.

Some light was thrown on the question as to whether the difference of starchy and glutinous grain is one of occurrence of these in different parts of the ear or not. It was only in the case of the sandy soil that any starchy grain was found, and here it was noticed that the difference between different ears in one and the same pot was greater than any between the grain

of different parts of one and the same ear. One would conclude that, as assimilation of starch goes on to the close, the more fully developed ears would be the more starchy ones. It was noted that when the ear was at all blighted, the grain was entirely glutinous and never starchy. Also, when starchy grains occurred they were found at the top of the ear rather than at the base.

This experiment is being repeated in 1900, and, in my opinion, it ought also to be tried on the practical scale in the field, as it is quite possible that under the conditions of growing plants in pots on the small scale the grain never gets properly ripened, but ripens prematurely, assimilation of starch never going on fully to the close.

## VI. "Smut" in Wheat.

It is a common practice to dress seed wheat with protective materials in order to guard it against the occurrence of "smut." The material in most general use is sulphate of copper ("blue-stone" or "blue vitriol") either alone or with bodies containing carbolic acid.

Attention has of late been drawn—and mainly through the action of the Royal Agricultural Society of England—to the quality of sulphate of copper as sold to the farmer, a so-called "agricultural sulphate of copper," containing a large amount of sulphate of iron, having been found to be sometimes used in its place, and also other adulterants of the genuine sulphate of copper.

Other materials and methods of treatment of seed wheat have been from time to time suggested, and it was thought well to try at Woburn the relative efficacy of these.

Sulphide of potassium is one such, and a comparatively new material is one of Danish origin, called "Ceres," which appears to have been tried extensively on the Continent and in America. It consists practically of sulphate of copper with sulphide of potassium. A still simpler method of treatment of seed corn is that suggested by Jensen (*Journal R.A.S.E.*, 1888, p. 397), which consists in merely steeping the grain in hot water (temp. 127°–133° F.) for ten minutes.

No dressings, it may be said, have been found to be entirely satisfactory in the case of barley.

Wheat grain which was very "smutty" was purposely selected for this trial. The grain was got from a miller, and those grains picked out which were "smutty," though not so damaged as to prevent germination. The soil used was that of

the farm, and each experiment was in duplicate, the arrangement being—

Pots 1 and 2 . . .	No treatment.
„ 3 „ 4 . . .	Seeds soaked in hot water.
„ 5 „ 6 . . .	Sulphate of copper (seeds steeped 10 mins. in a solution of 1 part to 220 of water).
„ 7 „ 8 . . .	“Ceres” dressing (seeds steeped 10 mins. in a solution of 1 part to 80 of water).
„ 9 „ 10 . . .	A “local dressing” (seeds steeped 10 mins. in a solution of 1 part to 15 of water).

The sulphate of copper used was “commercial pure.” The “Ceres” dressing was practically half sulphate of copper and half sulphide of potassium. It readily absorbs moisture and becomes deliquescent and then useless, so it has to be kept in a closed bottle. A further disadvantage connected with its use is that the recommendation is given to treat the seed three or four days at least before it is sown. The local dressing was a mixture of sulphate of copper and carbolic compounds; it was found to contain 24·77 per cent. of sulphate of copper, and would keep quite well even if freely exposed. The strengths in which the various dressings were used were those which had been put forward as recommendations in either case.

The wheat seed was (except for pots 1 and 2) dressed and then sown on December 17, 1898. It germinated fairly satisfactorily. No great difference was noticed during the time of growth, but the set with hot water treatment was, if anything, the most luxuriant.

By July 18 it was seen that some of the ears, especially in the case of the untreated lots (pots 1 and 2), would turn out to be “smutty.” On July 29 this was clearly apparent. The crops were cut on August 2, air-dried, bagged, and the grains subsequently weighed and sorted.

The result is summarised in the following table, the average of the duplicate pots being given :—

—	Total weight of corn	No. of grains		Weight of corn	
		Smutty	Clean	Smutty	Clean
	grammes			grammes	grammes
1. Untreated . . .	4·7	88	96	1·80	3·39
2. Hot water . . .	7·7	—	205	—	7·65
3. Sulphate of copper . . .	7·3	17	170	0·19	7·06
4. “Ceres” dressing . . .	6·1	17	181	0·27	5·83
5. Local dressing . . .	8·0	—	217	—	7·97

From this it was clear that all the applications had a protective influence, for the untreated pots had nearly as much “smutty” wheat as clean. The protection was most complete with the hot water and the local dressing. In this latter it will

be borne in mind that there was more sulphate of copper than in any of the others, the steeping solution being more concentrated. The result from the "Ceres" dressing was about the same as that from sulphate of copper alone, but, considering the relative strengths of sulphate of copper in these two and the local dressing, it would appear that the increased strength in the local dressing was of benefit and at the same time did not affect either the germination or the quality of the crop injuriously. But no treatment was more effectual, nor, of course, cheaper, than the simple one of steeping the seed in hot water. Care must be taken that the temperature does not sensibly exceed 133° F., or else germination may suffer.

#### VII. *On the Use of Nitrate of Soda containing Perchlorates.*

Attention having been called to the occurrence of perchlorates in certain samples of nitrate of soda, the question was raised as to whether these salts would exercise an injurious effect upon vegetation. The difficulty arose originally from purely commercial considerations, it being maintained that the ordinary "refraction" method of analysis (according to which commercial analyses of nitrate of soda are made) did not allow for the occurrence in the salt of perchlorates, and that consequently the manufacturer obtained in his nitrate of soda really less nitric acid than he had to pay for. I believe this case to be much overstated, especially as I experienced considerable difficulty in getting a sample of nitrate of soda with an appreciable amount of perchlorates in it. The commercial aspect does not, however, concern us here, but I thought it well to test the possible harm which such compounds might exert on crops to which nitrate of soda containing them was applied.

Accordingly, I sowed barley in four pots, side by side, on May 5, 1898, and to two of them I applied on June 28 as a top-dressing, at the rate of 1 cwt. per acre, nitrate of soda free from perchlorates, and to the other two, at the same rate nitrate of soda which contained over 2 per cent. (2.15 per cent.) of potassium perchlorate.

Little difference was noticed throughout the growth, but the barley to which the perchlorate containing nitrate of soda was put was certainly not inferior to the other, and there was no sign whatever of injury to the crop. At the time of harvesting the weight of corn and straw was quite as good with the perchlorate as where it had been excluded.

#### VIII. *On "Martellin" (Silicate of Potash Manure).*

The value of silica, in the form of silicates, as a manurial agent has been repeatedly affirmed and as often denied. Silica

exists to a large extent in plants; wheat, *e.g.*, contains a great deal, especially in the straw and chaff, but wheat has been got to grow quite well in the entire absence of silica.

Under the name "Martellin" a silicate of potash has been introduced as a manure, and its use recommended for crops such as hops, tobacco, clover, &c., which benefit from potash. It was decided to try its efficiency upon clover.

Six pots were filled with the Woburn soil and red clover seed sown in them. Immediately after sowing the following treatment was adopted:—Pots 1 and 2 untreated. Pots 3 and 4 sulphate of potash at the rate of 2 cwt. per acre. Pots 5 and 6, "Martellin" at the rate of 4 cwt. per acre.

The 4 cwt. of "Martellin" contained practically the same amount of potash as did the 2 cwt. of sulphate of potash. The crops were cut and weighed, and though the duplicates did not agree well with one another, making it misleading to give detailed figures, it could not be said that there was any benefit shown by the use of the "Martellin" in the case of red clover.

#### IX. *Other Miscellaneous Experiments.*

In addition to those detailed above, the Pot-culture Station has been utilised for several other experiments which will be dealt with elsewhere, or the results of which are not, for one reason or another, worth putting on record. One series was in connection with the field experiments on the prevention of "Finger and Toe," another on the growing of different varieties of early malting barleys, while a more extended series has been that on the prevention of weeds common in agriculture, an account of which is given in the *Journal R.A.S.E.*, 1900, Part I., p. 110.

Altogether, the Pot-culture Station at Woburn has provided the means of carrying out a large number of experiments on subjects of very varying character which could not possibly have been conducted in the field. As one may well expect, the methods that have to be adopted are those needing special care and also experience. But, as each year passes, these will be better understood and the results become more trustworthy. As a guide mainly to the selection of what may be subsequently tried on a practical scale in the field, I regard the pot-culture experiments as most useful, and look confidently forward to their affording valuable results in the future.

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## THE BRITISH EGG SUPPLY.

NEARLY fifty years ago a statement was published<sup>1</sup> concerning eggs to the effect that "This article of our imports is largely increasing, as appears by the fact that in 1849 ninety-seven millions of eggs were brought into this country, and in 1850 one hundred and five millions. We hope to see this importation as much a matter of almost incredible history as is that which tells us that three centuries ago we imported salads from Holland." The writer of this paragraph, if he is still alive, has failed to realise his hope, and must have long ago abandoned all immediate anticipation of seeing its accomplishment. Last year (1899) we received from foreign countries upwards of one thousand nine hundred and forty millions of eggs—an increase in forty-nine years of eighteen hundred and fifty per cent. The late Mr. John Algernon Clarke, writing in 1866 "On Increasing our Home Production of Poultry,"<sup>2</sup> gave statistics showing that by 1865 the imports had grown to three hundred and sixty-four millions, and asked the pertinent question: "Cannot we compete with foreigners under the disadvantage of having to convey their fragile and perishable commodities over long journeys and voyages, with the expense of commission agents at the distant market, and a duty of a penny a dozen levied upon their eggs?" Were the ability present, its exercise has not been equal to the task. Other factors have made their influence felt. Since 1850 and 1865 alike population has grown, the towns and urban districts have spread in every direction, wealth has multiplied among nearly all classes, and the taste of our people has changed. But, also, the world has sensibly shrunk, inter-communication between nations is comparatively easy, and the pressure of circumstances, together with the breaking down of barriers, some natural, some artificial, have changed ideas and methods, suitable perhaps to a past age, but out of place in this closing year of the nineteenth century. Hence we may fitly survey and endeavour to understand the position now existent, both in respect to the question of the national food supply, and to that of the producers.

<sup>1</sup> *Cottage Gardener*, April 22, 1852.

<sup>2</sup> *Journal R.A.S.E.*, 2nd Series, Vol. II. 1866, p. 339.

## COMPARATIVE IMPORTS.

In order that we may realise the position of eggs in relation to the demand for food of a similar class, it is necessary to

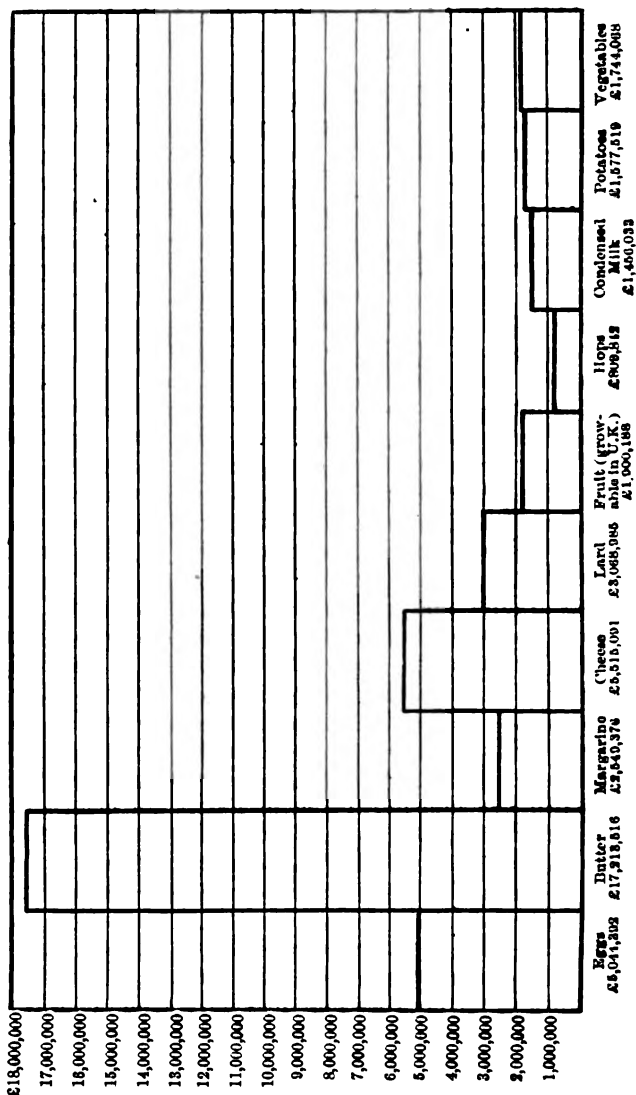


FIG. 1.—Comparative Diagram of Food Imports, 1922.

compare the imports of various articles. These are shown in fig. 1, which has been purposely limited to supplies which can

fairly be reckoned as producible at home. Hence grain and meals, meat, and all products the demand for which, owing to climatic or other reasons, could not be met by the United Kingdom, are omitted. The money values only are shown; for however instructive the relative quantities might be, they would be useless for such a table. The question is one of pounds, shillings, and pence, which appeal to us more than do weights or measures. From this table it will be seen that with the exception of butter and cheese the imports of eggs in 1899 were considerably greater than those of any of the products enumerated, and that the amount paid in hard cash for eggs was within half a million pounds sterling as great as that sent out of the country for cheese, and nearly a third of the value of the butter imported. The relative increase in imports of eggs during the last three decades is shown by the following comparisons:—

	Increase 1899 over 1869	Increase 1899 over 1879	Increase 1899 over 1889
Eggs . . .	347 per cent.	119 per cent.	61 per cent.
Butter. . .	148 "	66 "	68 "
Cheese. . .	78 "	44 "	23 "

From this it will be seen that whilst the increase in the imports of butter during the last decade has been a little in excess of that of eggs in the same period, the growth in twenty and thirty years respectively has been enormously greater in eggs than in butter. Whatever has been urged as to the necessity for giving attention to dairying is equally applicable in connection with poultry-keeping.

### HOME PRODUCTION.

Before dealing with the imports of eggs in detail, it will be of interest to inquire whether foreign supplies have displaced home produce, or provided for an increased consumption. If the former were true the question would be very serious indeed. But there can be no doubt that the consumption of this article of food has grown far in excess of the imports. More fowls are kept by farmers and cottagers than was ever the case before. Recently a member of the Council of the Royal Agricultural Society informed me that in one village on his estate, where a census had been taken, it is the fact that ten fowls are now kept where one was maintained five years ago. At a village in the Craven district of Yorkshire I was told that fowls have multiplied twenty-fold. In a paper read at

the National Poultry Conference at Reading last year by Mr. Charles Williams, of Newcastle-on-Tyne, reports were given as to the results of technical education in Poultry-keeping, and among these was one from Mr. Maudson Grant, Organising Secretary for the Lindsey Division of Lincolnshire, who stated that "Instead of being kept only at the farmstead as in past years, fowls are now kept largely in movable houses, which are shifted from field to field, constant change and fresh run being thus obtained. . . . I believe the number of fowls has increased in the ratio of two to three, and the production of marketable eggs and poultry as two to four." Many instances could be quoted of a similar kind relating to nearly all English counties, varying, of course, in degree of advance. These refer only to the developments in connection with Agriculture, and do not include such as are to be met with in the industrial centres, more especially of Yorkshire and Lancashire, where the increase in the number of poultry kept has been phenomenal. But the evidences are apparent, even to the ordinary traveller, who notices as he passes through the country poultry houses and fowls in fields where a few years ago there were none.

In 1884 and 1885 the Agricultural Returns included statistics of poultry; and it is a matter of regret that this valuable feature has not been continued; incomplete they doubtless were, though not nearly to the extent commonly supposed. The figures recorded that in England there were only 495 fowls per thousand acres of cultivated land. When—and this word is used advisedly, for we cannot long continue without returns as to this branch of live stock—this section is re-introduced, it will be found how great has been the advance. My own calculation is that the poultry produce in 1899 was 2,000,000*l.* greater in value than ten years ago, and of this about 85 per cent. would be represented by eggs. In Ireland the number of fowls kept has increased by more than 20 per cent. in the same period, and it is probable that my estimate is below the true advance. Hence it will be evident that only a vastly greater consumption can account for the growth of foreign imports.

#### CHANGES IN FOOD CONSUMPTION.

There are many reasons suggested for this increase. The population of Great Britain since 1869 has advanced 16 per cent., but if it were simply a question of more mouths to fill, and home supplies had proportionately grown in the same ratio, our foreign egg bill for 1899 would have been only 1,307,141*l.*, or very little in excess of the imports for the first quarter of

that year. We must seek for reasons other than increase of population. During the last generation the standard of living in this country has been raised to an extent never known before within so short a period of time. National wealth has grown by leaps and bounds, and by a wider distribution the purchasing power of the lower middle and of the artisan classes has enabled the bulk of our people to live in a way unknown to their forefathers. Unfortunately the increase of population has been entirely in the towns and manufacturing districts, for rural centres have shown a serious decrease. To this fact must be attributed the advance of imports. Greater means create greater needs, which must be met, and the demand was provided for by foreigners, whose methods of farming were adapted to the new conditions at a time when British agriculturists showed little disposition to change. But it is not merely a question of increased ability to pay. There is no fact more evident than that changes in methods of life create the need for different food. A man who lives chiefly in the open air, whose labour is physical, who expends his muscular energy in daily toil, can assimilate and enjoy food of a nature that would be unsuitable for and repellent to the worker in a city, either in office, or store, or factory, as the atmospheric influences are by no means the same. Dr. Emil v. Wolff,<sup>1</sup> the well-known German authority, says that "The food required to produce work varies with the form of muscular activity or the work done." And Sir Henry Thompson<sup>2</sup> has stated that man "is apt to leave out of sight the great differences, in relation to both quantity and quality of food, which different habits of life demand, *e.g.* between the habits of those who are chiefly sedentary and brain workers, and of those who are active and exercise muscle more than brain."

The fact which it is sought to make clear, and consideration of which might be greatly extended, is that the growth in consumption of what has already been termed the lighter articles of food is directly the result of changes in habits of life and of work, rather than of increased purchasing power on the part of great masses of the community. Among these foods eggs occupy an important place. Sir Henry Thompson in the work referred to speaks of them as "perfect food." Dr. Edward Smith, F.R.S., writes:<sup>3</sup> "It would not be possible to exaggerate the value of eggs as an article of food, whether from their universal use, or the convenient form in which the food

<sup>1</sup> *Farm Foods*, English edition, p. 84.

<sup>2</sup> *Food and Feeding*. By Sir Henry Thompson, F.R.C.S. 2nd edition, 1881, pp. 19-20.

<sup>3</sup> *Food*. Tenth edition, 1890, p. 95.

is preserved, presented, and cooked, and the nutriment which they contain." Such a fact is of great importance to the producer, who must look forward and endeavour to anticipate future developments. If the use of eggs as food were merely a fashion, a temporary phase in taste, and did not meet a real need, we should pause ere suggesting that dependence be placed by agriculturists upon continuance of and increase in demand. But what has been stated must prove that such is not the case, and that with the growth of our commercial and industrial populations, with the advance of education, with the cultivation of brain not less than of brawn, those foods, of which eggs stand in the first rank, which contain nutriment in a concentrated and easily assimilated form, must be provided to a greater extent than ever before. The same evidences are met wherever like conditions prevail, or where, by reason of climate and labour, lighter food is essential. To this cause must be attributed the marvellous growth of egg and poultry consumption in America. An estimate was recently made that in the United States the value of the poultry crop (of which eggs would probably absorb 80 to 85 per cent.) was, two years ago, equal to 59,500,000*l.*, or 6,355,000*l.* greater than the cotton crop, and 10,865,000*l.* greater than the wheat crop of that country.

As a further evidence of this great alteration in manner of life, mention must be made of changes in cookery, as a result of variation in food. During the past generation these changes have revolutionised our table supplies. Under modern conditions variety in food is an absolute necessity in order to stimulate the appetite, without which that energy necessary to the performance of a man's work would be unavailable. From whatever position, therefore, we approach this subject, the conclusion arrived at is that the consumption of eggs is a natural result of alteration in our methods of life, and that in the future demand is likely to increase even to a greater extent than has hitherto been the case. In a return published by the Municipality of Paris it is stated that the average consumption in that city was, in 1898, equal to 212 eggs per head of the population. We have no means of obtaining equally reliable figures as to London, but the average for Great Britain in the same year would be rather over 130, and it is not unreasonable to assume that the metropolitan average was higher than that of the country generally.

#### IMPORTS.

It is impossible to suggest to what extent the consumption of eggs has increased during the past thirty years, inclusive of

both home and foreign supplies. I do not think that the growth of production at home has been greater than that of imports from Ireland and foreign countries. Probably, in 1869, of the eggs consumed in Great Britain half were native, one-fourth Irish, and one-fourth foreign. In 1899 the position was

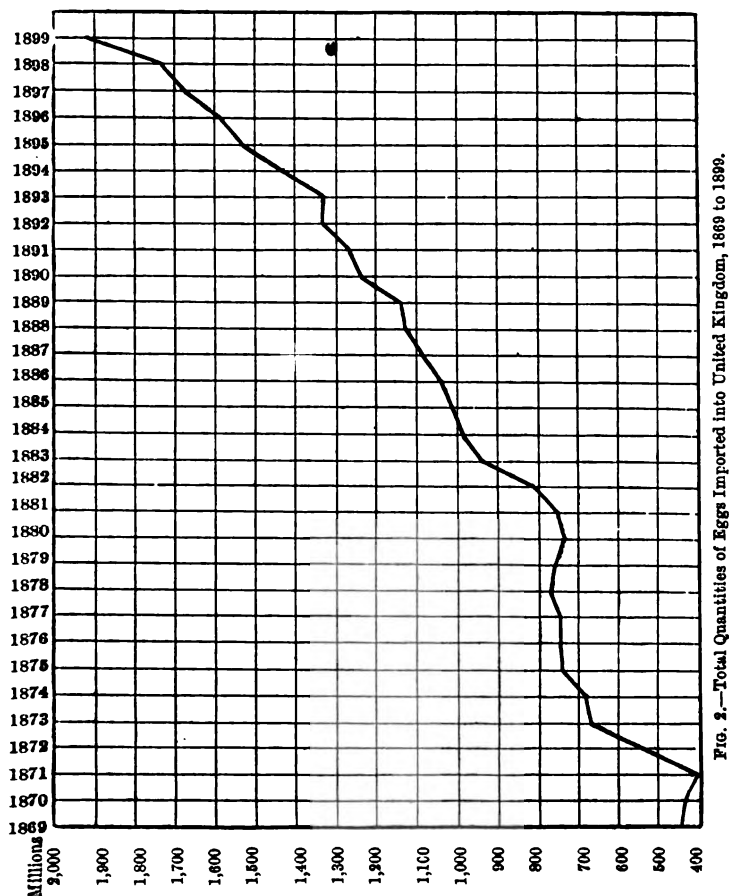
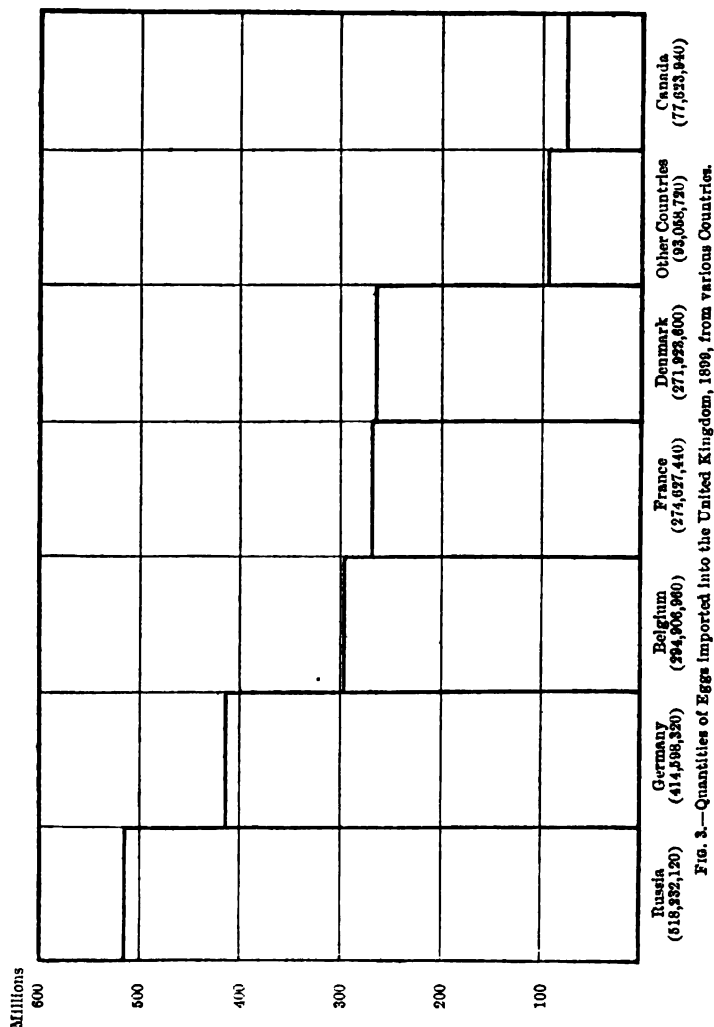


FIG. 2.—Total Quantities of Eggs Imported into United Kingdom, 1869 to 1899.

reversed, as one-half would be foreign, rather less than one-third British, and one-sixth Irish.<sup>1</sup> This is an estimate based upon many observations, but which cannot be supported by actual statistics. When we come to the foreign imports we are upon

<sup>1</sup> In this estimate it is assumed that home eggs have been higher in price than foreign or Irish, and these proportions represent quantities, not values.—E. B.

safer ground, for in respect to these figures are available. Fig. 2 indicates the increase of these imports year by year, and deals with quantities only. It will be seen that the increase has been, with one or two exceptions, constant throughout the



three decades comprised within this diagram. We must think in millions when dealing with the question of egg supplies. It will, however, be of value if we quote from the Agricultural Returns the imports of eggs per head of the population; the

following are the last figures obtainable, at intervals of five years, from 1869 to 1898 :—

1869 . . . 14	1884 . . . 28	1894 . . . 37
1874 . . . 21	1889 . . . 30	1898 . . . 43
1879 . . . 22		

But it is necessary to point out that the population upon which these averages have been based is that of the United Kingdom, inclusive of Ireland, which, being a producing, and not a purchasing, country, so far as eggs are concerned, except to a very limited extent, should be omitted. In 1899 the average consumption of foreign eggs in Great Britain was 55 per head of the population. On this basis all the figures given in the Agricultural Returns should be increased by about twenty per cent.

#### WHENCE EGGS ARE IMPORTED.

When we examine the imports in detail it is seen from over what wide areas supplies are obtained. Some of the countries are shown in fig. 3; but this is incomplete in one important point—namely, that the actual countries of origin are not thereby indicated. The eggs enumerated as received from France, Denmark, and Canada come direct. But of the vast quantity credited to Germany, very few, if any, are German, but pass through that country from Southern Russia and Austria-Hungary, whilst of the so-called Belgian supplies only about ten per cent. are actually produced there, ninety per cent. coming from Italy and Western Austria. Under the item “Other Countries” is included the produce of many nations which contribute their quota to make up the total bulk. At the time of writing, the last complete numbers available are for 1898, and it will be of interest to quote these :

Chile . . . . . 27,000	Portugal . . . . . 12,084,000
Egypt . . . . . 17,926,000	Spain . . . . . 15,123,000
Holland . . . . . 7,286,000	Sweden . . . . . 794,000
<sup>1</sup> Italy . . . . . 200,000	Turkey . . . . . 226,000
Morocco . . . . . 9,466,000	United States . . . . . 23,293,000
Norway . . . . . 10,000	

From some of the British possessions, in addition to Canada, small supplies are received :

Channel Islands . . . . . 661,000	Gibraltar . . . . . 222,000
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<sup>1</sup> Received direct by sea, and not included in those coming *via* Germany or Belgium.—E. B.

Much has been said as to eggs coming to us from the Antipodes, but this trade is of more recent development.

#### FLUCTUATIONS OF IMPORTS.

It is of interest to note the fluctuations in foreign supplies, for great changes have taken place, especially during the last ten years. At one period France was the source whence was received the largest quantity of foreign eggs. But that country now occupies the third position, and the first place is held by

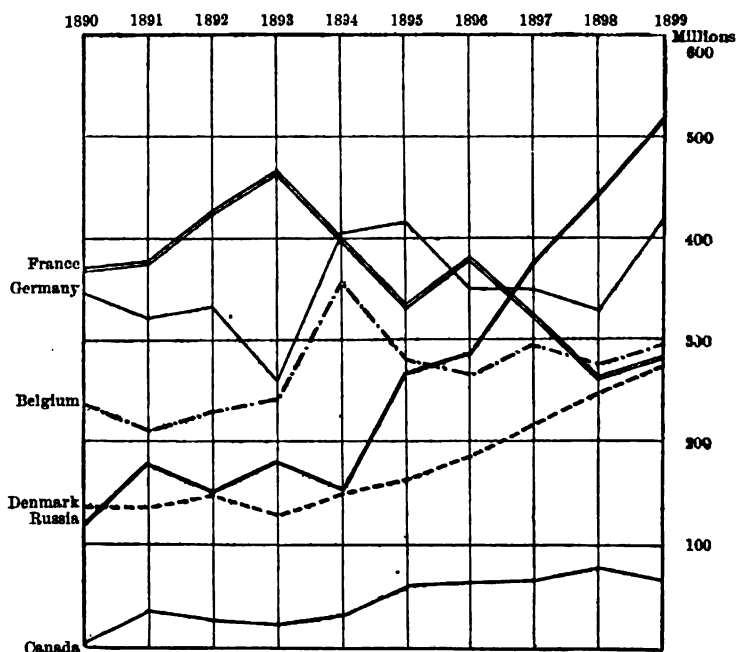
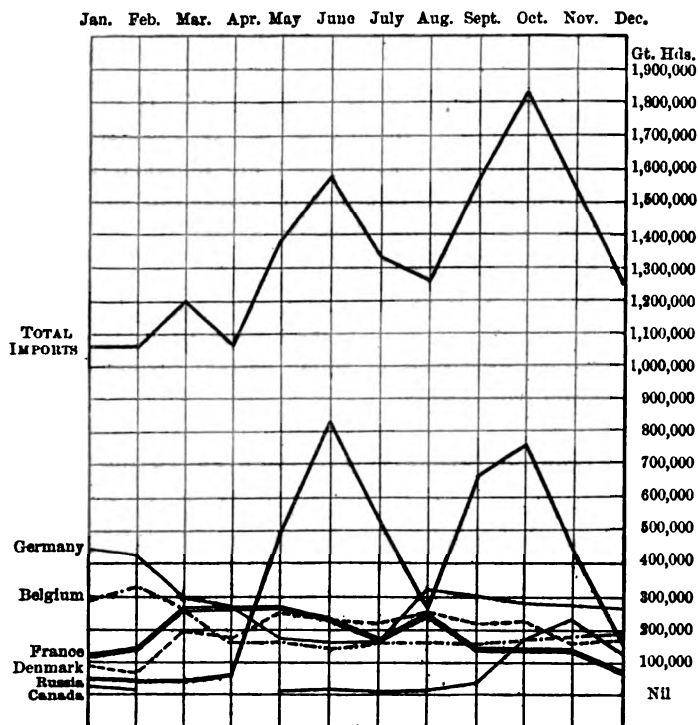


FIG. 4.—Imports of Eggs from various Countries, 1890 to 1899.

Russia, even to a greater extent than is shown by the Returns, for, as previously explained, the supplies from Southern Russia arrive by way of Germany. It is to be regretted that we have no direct evidence as to the quantities derived from Italy and Austria-Hungary, but in fig. 4 are given the statistics as available. These are restricted to the past ten years, as this is sufficient to indicate the way in which the countries of supply have fluctuated in the extent of their contributions to our markets. It will be seen from the diagram that, whilst the tendency all round is towards an increase, with the exception

of Denmark and Canada—where the rise has been maintained very steadily—the fluctuations have been considerable. Most noticeable among these is the decline of imports from France, and the rapid and enormous growth of the Russian egg-trade. There appear to have been several influences at work to account for the decline in French supplies. Owing to alterations in the fiscal policy of the Republic, Italian eggs are not used in



NOTE.—From Canada no supplies were received in the months of March and April.

FIG. 5.—Monthly Rise and Fall of Imports of Eggs in 1899.

the South of France to the same extent as was formerly the case, and their place has been taken by native produce, which was at one time exported to England. Also, until recent years Italian eggs in considerable numbers came by way of France; but, owing to competition of alternative and shorter routes, the traffic has been deviated through Germany and Belgium. But probably the chief cause is due to the increase of British egg production, the demand for best quality eggs being to this extent met by home supplies, and, consequently, the rates

obtainable for French are not as good as they were ten to twenty years ago. The average price of these eggs is about 1s. per great hundred (*i.e.* per 120) below those recorded in the previous decade, and better returns can be obtained in Paris than in London. The phenomenal growth of the Russian supplies is to be explained, not so much by any great advance in production of eggs in that country as by commercial enterprise. Several firms, chiefly English, have organised the collection, packing, and shipment of eggs, and they must be awarded the credit for the development recorded. Amongst these may be named Messrs. J. Robinson & Co., of West Hartlepool and Riga; Messrs. Rickehaus & Co., of London, Hull, and St. Petersburg; and Messrs. Bewlay & Co., of London and St. Petersburg. To the two last-named I am indebted for many courtesies and a mass of information respecting the Russian egg-trade. In this connection it is of interest to note the respective quantities of eggs imported for each month of 1899, which are shown in fig. 5, the diagram explaining itself. It is noticeable that the individual countries show considerable fluctuations. During the winter months a large proportion of the eggs imported are preserved, of which system further information is given on page 644.

#### VALUE OF INTERNATIONAL POULTRY TRADE.

An examination of the international trade in poultry produce reveals that this branch of commerce is a very important one. The following figures are quoted from a valuable paper by Mr. Goulichambaroff, read at the International Poultry Congress, held at St. Petersburg in 1899, entitled "*Commerce Internationale de la Volaille et des Produits Avicoles*," and includes both imports and exports in the respective countries for the year 1897:—

Germany . . . . .	£7,467,291	Cape of Good Hope and Natal . . . . .	£597,083
Great Britain . . . . .	7,065,416	Spain . . . . .	347,708
Austria-Hungary . . . . .	7,062,500	China . . . . .	211,041
France . . . . .	5,701,770	Canada . . . . .	206,879
Russia . . . . .	3,777,666	Roumania . . . . .	185,625
Italy . . . . .	1,901,354	Turkey . . . . .	127,916
United States . . . . .	1,353,637	Finland . . . . .	112,500
Belgium . . . . .	1,344,800	Sweden . . . . .	98,333
Denmark . . . . .	821,561	Norway . . . . .	74,166
Holland . . . . .	789,479	Japan . . . . .	52,875
Switzerland . . . . .	747,291		
		Total . . . . .	£40,067,081

This table omits several countries from which poultry produce is imported into Great Britain, notably Egypt and Morocco. I have no means of knowing the source of M. Goullichambaroff's information; but that gentleman is connected with the Ministry of Finance at St. Petersburg, and probably his figures are approximately correct. They, however, apply only to international trade, and do not include sale of produce in the countries of origin. The total trade is divided as follows:—

Eggs . . . . .	£ 21,669,424
Fowls, living and dead . . . . .	6,482,695
Down and feathers . . . . .	11,008,154
Manure . . . . .	928,458
Total . . . . .	<u>£40,088,731</u>

Of this sum of rather more than forty million pounds sterling, nearly twenty-two million pounds are represented by the egg trade. Of the countries named on fig. 5, with the exception of Denmark and Canada, the poultry exports are to a large extent surplus products. In each there would appear to be a steady increase of late years, due to fresh outlets, and consequently an augmented demand, but without any attempt to develop the industry on similar lines to those followed in Denmark and Canada, which it has been our purpose to accomplish during the last twenty years in Great Britain. The Danish egg trade has been practically created within the last two decades, and that of Canada, so far as exports to this country are concerned, was the result of the McKinley Tariff Act passed in the United States nearly ten years ago. Up to that period Canadian eggs found their market in the United States, but producers on the introduction of the tariff named had to secure a fresh outlet. The result appears to have proved satisfactory, for poultry-keeping, thanks to the encouragement of the Dominion and Provincial Governments, has increased to a considerable extent.

#### RELATIVE VALUES OF IMPORTED EGGS.

With so perishable an article of food as eggs, with which freshness is a supremely important consideration, it is to be expected that the quality will vary. This is evidenced by the declared values, which, however, can scarcely be regarded as altogether reliable. Still it is an indication of relative qualities,

and the following are the average values per great hundred for 1899, taken from the Trade and Navigation Returns :—

	s.	d.		s.	d.
Russia . . . . .	5	5½	France . . . . .	7	7
Denmark . . . . .	6	0½	Canada . . . . .	7	2½
Germany . . . . .	5	7	Other Countries . . . . .	6	0½
Belgium . . . . .	6	2	General Average . . . . .	6	2½

It may be explained that the general average price was higher than in 1897 and 1898, but a little below that of 1894, 1895, and 1896 respectively. By selecting four months of the year we obtain an insight into the fluctuations in prices of eggs from the different countries :—

From	January		April		July		October	
	s.	d.	s.	d.	s.	d.	s.	d.
Russia . . . . .	6	6½	5	0½	4	11½	5	9½
Denmark . . . . .	8	2½	7	2	6	4	7	10
Germany . . . . .	6	0	5	5½	5	4½	5	6
Belgium . . . . .	6	3	6	3	6	2	6	1½
France . . . . .	8	5½	7	11½	6	7	8	2½
Canada . . . . .	6	10½	—	—	5	5	6	11½
Other Countries . . . . .	5	11	5	3	6	5½	6	2½

These figures very clearly show that distance from the British markets, and consequent degree of freshness, determine the price at which the eggs are sold. In every one of the above months French supplies command the best rates, with Denmark a good second, and these countries are about the same relative degree in distance from, and in time occupied in transit to, our shores. When in Russia I was informed that large quantities of eggs are exported thence to Denmark, where they are re-packed; and other evidence has been obtained of the same nature. It may be hoped that it is not so, otherwise the Danish trade must suffer as a result. The low price of eggs received from Germany is owing to the fact that a considerable proportion are Russian.

When we compare the actual qualities of eggs placed upon the market, it is at first difficult to realise that the low grades can be in demand for food. Egg importers, by testing and re-packing, divide the bad eggs, known as "blacks" and "spots," from those which are passable. But many of the former are utilised, or the margin of profit is greater than in other branches of commerce. Eggs which have travelled 2,000 to 3,000 miles, and consequently are from three to six weeks old at least, cannot but be seriously reduced in food value. So far as I have been able to learn, the system of col-

<sup>1</sup> A reference to fig. 5 will show that the bulk of the Canadian eggs were received in the last three months of 1899.

lection is by no means a speedy one in Eastern and Southern Europe, and cannot be compared with that adopted in France and Denmark. It is assuredly a fact that eggs cannot be placed upon our markets from any part of Europe whilst in their pristine freshness, but such as arrive from the more distant parts of the Continent are vastly inferior to those emanating from the nearer lands. It would appear that great quantities are used for confectionery and pastry-making, and a newer development is shipping separately the whites and yolks packed in drums, the "cracks" being shelled, divided, and forwarded in this manner. Large quantities of eggs are employed in manufacturing processes, especially the whites, but to what extent foreign supplies are so used it is impossible to form any opinion. We may, however, accept the statement that certain classes of foreign eggs provide for a need which, by reason of price, could not be met by home producers, who would find the return inadequate and the business unprofitable. To that extent, therefore, we can welcome these imports.

#### IRISH EGG SUPPLIES.

As previously explained, during the past dozen years there has been a steady increase in the number of poultry kept in Ireland, and in the exports to Great Britain. It may fairly be assumed that the total supplies of eggs annually exceed in value 1,500,000*l*. That there has been in many directions a decided improvement in the quality of Irish eggs is unquestionable, owing to the adoption of better methods by traders, and to the efforts of the Irish Agricultural Organisation Society. As a consequence, the best qualities of Irish eggs have attained a position and command a price which formerly they did not deserve. But there is much to be done in many parts of that country, especially in the ensuring of rapid marketing and securing better packing. It is regrettable that producers and exporters have not yet fully risen to their opportunities. There is no better egg in the world than the Irish, but too often, as the consequence of indisposition, want of energy, and non-realisation of its perishable nature, instead of occupying the first place among extraneous supplies, it has to compete with third and fourth grades of foreign produce.

#### PROGRESS IN BRITISH POULTRY CULTURE.

For many years the desirability of paying greater attention to the production of eggs and poultry in this country has been advocated, at one time with very little apparent result. But

within the last decade, as we have already seen, considerable progress has been made, not only in the number of fowls kept in the rural districts of the country, in the class of fowls maintained, and in the number of eggs, chickens, &c., marketed, but also in the average productiveness of the fowls. This last-named fact is not recognised to the extent its importance deserves. For years we have been informed *ad nauseam* that pure races of poultry are inferior to the barn-door fowls of a bygone age, that breeding for external characters has reduced the stamina (which in some cases is true), and has decreased the productiveness of domestic poultry. But it is a pertinent fact that correlative with the increase of pure races of poultry upon farms, or the greater use of pure male birds, and disappearance of the mongrel specimens generally described as "barn-door" fowls, there has been a striking advance in the average number of eggs produced. Much of this advance must be attributed to the newer breeds of a more profitable type, introduced during the past thirty years, breeds built upon what the Americans call "business" lines, but which are often stigmatised as "mongrels" by those who are ever claiming the superiority of the so-called "barn-door" fowl. As Mr. Lumley Hodgson has said<sup>1</sup>: "The foundation of all improvement is judgment in selection," and our pure races are the result of this selection. It is not necessary to discuss this question at length in the pages of the Journal issued by the Royal Agricultural Society of England, for it is regarded as a settled fact in relation to larger stock, and what is true in that case is equally applicable to the breeding of poultry. Those who can remember the farm poultry of twenty years ago will agree that they were of a heavier, more indolent type than is the case to-day, exhibiting a considerable amount of Cochin or Brahma blood, and were not characterised by great prolificacy. As the profit a hen will yield, when kept primarily for egg production, depends upon the number she lays beyond those required to pay the cost of her maintenance, it will be evident that the increase of productiveness is as necessary in the case of fowls as in that of dairy cattle.

From evidence which has been obtained by careful observation in almost every section of Great Britain, I am justified in placing the average production of the British hen at twenty eggs per annum in excess of that of twenty years ago. In many places the average would be much higher, but this is a mean

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<sup>1</sup> Journal R.A.S.E., 2nd Series, Vol. XIX., p. 9.

which does not err on the favourable side. Such an advance is but a moiety of what is possible of accomplishment, but, combined with the lower cost of food, and thus a gain on both sides without any fall in prices to counterbalance, it shows that even if poultry-keeping could not be made profitable a generation ago, which we are not prepared to admit, the condition of things has entirely changed. As a consequence farmers now regard poultry in a very different manner from their fathers. A new generation is arising, one brought up in the time of stress and loss, and consequently more disposed to try new developments. Arable farmers are coming to see that poultry may not only be kept without injury to growing crops, by taking reasonable precautions, but be of service in maintaining the balance of nature which our intensity of cultivation upsets. Mr. J. R. Woodhouse, writing in one of the weekly journals,<sup>1</sup> gave his experience, which is worthy of quotation :—

Last spring I planted a field of barley, and it so happened that I did not go near it again for some nine or ten days. Now, when I did visit the field I found that my fowls had been there and had played such havoc, as I thought, with a portion of the field, that I concluded it would have to be replanted. I, however, was not in a position to do so at once, and before I could make it convenient the barley was up. I then found that this portion of the field was certainly not so thick as the rest. Still, I thought if it should rid (or stool, as it is sometimes expressed) it would do so, and therefore I did not interfere with it. I did not do so, and I harvested a very fair crop. About a fortnight after it came up there appeared unmistakable signs of wireworm in various parts of the field, but no indication whatever of there being any in that portion of the field where the fowls had been at work. I therefore did nothing to this, but applied a dressing of nitrate of soda to the rest of the field, that being the best remedy I ever could discover for this pest. It had the desired effect; but taking it as a whole, the portion of the field thus dressed was no better than that where the fowls had been, which was not so treated. I was mentioning the circumstance to an acquaintance of mine, and he said his uncle some thirty years ago went over Tiptree Hall, and, afterwards meeting the late Mr. Mechi, had some conversation with him, and expressed surprise at his allowing his poultry to run over the fresh-planted fields. His reply was "that if the grain was put in sufficiently deep he considered they did more good than harm, as they picked up a number of insects that were injurious to the crop." This theory, which I have no doubt would have been laughed at by many farmers, and which at one time I should have treated with ridicule myself, this year proved correct in my case."

#### RELATIVE MONTHLY IMPORTS.

Great though the progress made has been of late years, there is much yet to be done ere home producers secure the most profitable trade in eggs. This subject is treated at length later

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<sup>1</sup> *Agricultural Gazette*, April 26, 1897.

on, but there is one point which must be mentioned now, as many of the recommendations we are about to make are based upon the need for increasing the production of eggs in winter, and of securing that regularity of supply which is essential in commerce. A reference to fig. 5 will show that supplies of foreign eggs are lowest from December to April. The following table will indicate the relative monthly proportions of the total annual imports for 1899 :—

January . . . .	6·7 per cent	July . . . .	8·2 per cent.
February . . . .	6·7 "	August . . . .	7·9 "
March . . . .	7·4 "	September . . . .	9·6 "
April . . . .	6·6 "	October . . . .	11·4 "
May . . . .	8·6 "	November . . . .	9·5 "
June . . . .	9·8 "	December . . . .	7·6 "

With the exception of August, from May to November covers the period of the year when imports are greatest. A reference to the figures on p. 618 will show that, in spite of large imports in October, the best qualities of foreign eggs were nearly as high in price in that month as in January. We may, therefore, divide the year into two equal parts, namely, from October to March, and from April to September, the former being the period of dearer eggs, and when home supplies begin to fall off. The success of poultry-keepers in this country is largely determined by their ability to obtain eggs from October to March, and thus receive returns much greater than at the other season. In every part of Great Britain we have evidence from traders that failure of supply in autumn and winter acts most prejudicially against home produce, and that they are then compelled to depend chiefly upon foreign, otherwise it would be impossible to provide for their customers. As a consequence, retailers prefer to deal with those who can meet their requirements at every season. Frequently attempts have been made to obtain a regular supply, but with small success, and hence the difficulty met with on the part of producers, who find retailers indisposed to take eggs when they are plentiful unless they can be assured of a fair quantity when scarce. That eggs can be, and are, produced in winter is indisputable, but the demand is so great even in rural districts that they are sold privately and immediately, without going through the hands of retailers. It may appear the best policy to sell on the spot, rather than send away for the same or very little more money. But when the plentiful time comes, and prices locally are low, then the traders refuse to assist producers, and there is a glut as a result. Better prices would follow in spring and summer if the supply were assured in winter. It is to winter egg production that farmers and

others must direct their efforts. There are dairy farmers who have cows calving during nearly every month of the twelve, and if it is necessary to accomplish our purpose we must hatch all the year round.

#### BREEDS FOR EGG PRODUCTION.

The improvement in average egg production already recorded has been due to many causes, of which selection has been one of the chief, as also has the substitution of pure races for mongrels. Not only have new breeds been introduced, but the qualities of such varieties as were existent are better understood. This is in keeping with advance in knowledge as to live stock of all grades. In most of the older books no attempt at classification in accordance with economic qualities is made. Many years ago I drew up the following division of breeds of poultry, the first time this form had been used, and since that date it has been very generally adopted:—

1. Laying or non-sitting varieties.
2. Table varieties.
3. General purpose varieties.
4. Ornamental varieties.

When a farmer had no such guide as this to help him in choosing a breed, he was very likely to be influenced by fashion or his own preference; but with such a classification before him he can at once learn which breeds are specially suited to his requirements. That the quality for practical purposes of our races of poultry has improved greatly is unquestionable. There may be, and are, directions in which the reverse is true, but regarding the question from a general rather than a sectional point of view, it is evident that the advance has been enormous, and equal to, if not greater than, that made in any other branch of live stock. I know it is customary on the part of many people to condemn exhibition poultry and poultry exhibitors, using the name "fancier" as a term of opprobrium. That name has been most unfortunate, but "what's in a name?" Poultry breeders and exhibitors have humbly followed in the path marked out by breeders of larger stock, who are fanciers in the same degree. That breeders of cattle and poultry have alike enormously improved the quality of our stock is unquestionable, and it is a striking fact capable of proof that fanciers obtain a greater average of eggs from their hens than do farmers. The truth in this case, as in many others, lies between the extremes, and whilst agreeing neither with the ultra-fancier nor with the anti-fancier, it must be conceded that much of the progress

made is due to breeders of pure races of poultry. Whether, with the increased attention paid to poultry by farmers, we shall need the fancier as much in the future as in the past, will depend entirely upon agriculturists themselves.

#### SELECTION OF BREED.

For egg production the breeds which give the best results are those included in the non-sitting and general-purpose classes. The finest races of table poultry do not excel as layers. In these latter races the average number of eggs produced will be comparatively low, and in many breeds will not be sufficient to do much more than pay the cost of maintenance. Their eggs are much more valuable as potential chickens. Whether a non-sitting or a general-purpose breed should be chosen must be determined by the farmer himself. As a rule the non-sitters give a better yield in eggs, but, from the fact of the maternal instinct being suspended, it is requisite to make other provision for hatching and rearing the young stock. And, probably, owing to their being non-sitters, they are not so prolific in winter as are the general-purpose breeds. A further point in connection with these non-sitters is that they are slighter in body, smaller in size, and less fleshy than the general-purpose races, and hence the surplus birds do not afford the same returns when sold. In this connection it is of importance to observe what is done in Belgium, where it is found that for milk chickens and *poulets de grains*, or spring chickens, the best results are obtainable by the use of non-sitters, as they grow so much more rapidly, are lighter in bone, and carry a greater amount of meat at the same age, than either table or general-purpose varieties. Such a fact will be of importance to those who keep the lighter breeds for egg production, as they can realise better prices for surplus cockerels if these are killed at an early age. In districts where there is a good demand for medium qualities of table poultry, and where yellow-fleshed fowls are not regarded as inferior, the general purpose breeds are preferred. The loss of a few eggs is more than compensated by higher prices for chickens. And if the breeder prefers to use natural rather than artificial methods of hatching and rearing, the latter should be chosen. It is entirely a question of balancing the respective qualities.

The breeds which rank under the two classes named are the following :—<sup>1</sup>

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<sup>1</sup> *Poultry Keeping as an Industry for Farmers and Cottagers*, by Edward Brown, F.L.S. Third edition, 1898. London: Edward Arnold.

*Non-sitting Varieties.*

Hamburgs.	Andalusians.
Campines.	Redcaps.
Minoreas.	Houdans.
Leghorns.	Scotch Greys.
Anconas.	Barbezieux.

*General-Purpose Varieties.*

Plymouth Rocks.	Orpingtons.
Wyandottes.	Brahmas.
Langshans.	

There is, as may be inferred, a considerable difference among the breeds included in this table. Some are to be preferred under certain conditions more than others, as we shall see later. But all are of practical value. The following brief descriptions of the chief egg-producing varieties are quoted from the work already named, with one or two additions:—

*Hamburgs.*—Small-sized, well-shaped bodies on longish legs; large sickle tail; full hackle, with neat head, and rose-comb; five varieties—blacks, gold-spangled, silver-spangled, gold-pencilled and silver-pencilled; all very rich in colour save the blacks—they lay too small eggs to be of marketable value.

*Campines.*—The great egg-producing breed of Belgium; resembling our pencilled Hamburgs, except that they have single combs; remarkable layers; small-sized bodies; two colours—gold and silver.

*Brackel.*—Small-bodied, very active, but prolific layers of eggs, which are large in size. The plumage is pencilled like that of the Campine, but the markings are a little coarser; two colours—gold and silver.

*Minoreas.*—Of the Mediterranean family; two varieties—namely, black and white, but the latter seldom seen; one of the most valuable breeds we possess as egg-layers; eggs very large.

*Leghorns.*—Of the Mediterranean type; active fowls of great precociousness; legs clean and yellow; several varieties, white and brown being oldest and best known; other colours are: cuckoo, black, pile, duckwing, and buff.

*Anconas.*—A mottled-plumage variety, nearly resembling Leghorns; excellent layers; medium-sized body; very hardy and precocious.

*Andalusians.*—A member of the Mediterranean family, which has been described as having a smallish-sized body, placed upon legs of a good length; the neck rather long, with a fine head; a large upright single comb in the cock; in the hen also large, but falling over on one side; and the cocks have large, sickle-shaped tails. Andalusians are clean-legged; colour, slate, except on the cock's neck and back, where it is dark purple, nearly black.

*Redcaps.*—Original type of the gold-spangled Hamburg; similar in colour, not so even in markings; very large comb; hardy, and prolific layers.

*Houdans.*—Of French origin; large size, broad and massive; clean legs, pale in colour, carrying a fifth toe; head crested; plumage mottled black and white.

*Scotch Greys.*—Most nearly like the Dorking in shape, and has white or speckled legs; plumage black and white.

*Barbezieux.*—Sometimes is called the French Minorca, as it is very similar in type to the English breed, though larger and more upright. It is a good layer.

*Plymouth Rocks*.—A breed of American composition; large in body; rather big in bone; clean yellow legs; four varieties—barred (cuckoo), whites, blacks, and buffs, the first named being most popular.

*Wyandottes*.—Another breed of American production, and one of the most recent; comb rose; legs clean and yellow; large-sized body; plumage laced; in four colours or varieties—silvers, golds, whites, and buffs.

*Langshans*.—Large Chinese fowls, on rather long legs; full tails, carried high; slightly feathered on the legs; comb single; plumage entirely black.

*Orpingtons*.—Really clean-legged Langshans, which they resemble, except that the legs are not feathered. A buff variety has lately been introduced, really a refined variety of the Lincolnshire buff, found in east of England.

*Brahmas*.—Large, full-feathered birds, feathers extending down the legs and feet; small, neat heads, with pea combs; two varieties—darks and lights.

### SOIL AND POSITION.

Choice of breed must be to a large extent influenced by the demand for produce, but there is a further question which has to be regarded, namely, soil and position. Climate in these Western islands is not of the importance usually supposed. Whilst there are distinctive differences in climate—and these ought to receive due consideration, especially as regards table poultry production—we are not met by the extremes which prevail in some countries. The nature of the soil should determine the choice of breed. On heavy or low-lying lands it is desirable to select a hardy breed. Under these conditions the yellow-fleshed races thrive best and give the most satisfactory results. In fact, it would almost appear that yellow flesh is the expression of heavy soil. At high altitudes and in exposed positions the yellow-legged non-sitting races, by reason of their activity of habit, should be chosen. But on the lighter soils and in the more sheltered districts choice is wide, and here the white- or dark-fleshed races may be selected. We shall, however, content ourselves by a summary as a guide to poultry breeders, of course within the scope of races characterised as heavy egg producers:—

Yellow-fleshed fowls: Leghorns, Anconas, Plymouth Rocks, Wyandottes, Brahmas.

White-fleshed fowls: Houdans, Scotch Greys, Buff Orpingtons.

Dark-fleshed fowls: Hamburgs, Campines, Minorcas, Andalusians, Redcaps, Barbezieux, Black Orpingtons.

### COLORATION OF SHELL.

A further point to be considered is the colour of the shell. Whilst not suggesting that tinted-shelled eggs contain more

nutriment than white-shelled, we cannot but recognise that for a first-class trade those eggs which are encased in a tinted shell will be preferred, and in some cases command the best prices. Traders have informed me that they can obtain from 3*d.* to 6*d.* per dozen more for the one than for the other. I fear the producer does not obtain his share of this increase, except that he finds a readier market, especially during the plentiful season; but he has a decided gain in that a smaller egg will be accepted if the shell is tinted than if it is white. It would appear that in the tinted-shelled egg the proportion of yolk to white is greater than in the larger white egg, and in many of the former the albuminous portion is of increased density. This problem of coloration of shell is one of great difficulty. For many years I have tried to find a satisfactory explanation as to why some races of poultry uniformly produce white eggs and others varying degrees of tint in the shell. The suggestions of naturalists as to coloration in eggs of wild birds fail to help us. Season does not affect the colour to any appreciable extent, nor food, nor soil, nor climate, nor colour of flesh, and the protective instinct which is said to enable many feathered races to change the tint of the shell of the egg is not in this case apparent. It is a striking fact that the general-purpose breeds, without exception, lay eggs with tinted shells; and that all the non-sitting races lay eggs with white shells. Of the table varieties the majority produce white-shelled eggs. This subject of coloration of shell in eggs laid by domestic fowls offers a virgin field for the investigations of any inquirer who may be disposed to undertake the task. The list of breeds already given on page 625 can be consulted, to ascertain which will give the tinted-shelled eggs. It has been proved that by breeding the depth of tint can be increased, and that is practically all we know at present.

#### WINTER LAYERS.

As regards the production of eggs at the time of year when they will yield the greatest return, it is necessary for the farmer to regulate his breeding operations. In view of what is stated when considering the question of marketing, it is important that hatching shall not be restricted to one period of the year, but by extending this part of the work breeders can control to some extent the output, and secure a more regular supply. Early maturity depends upon the location where the birds are reared, as a cold, damp place will retard growth, whilst during a hot summer open ground exposed to the full

glare of the sunshine has the same effect. A warm, sheltered position during the colder months, and plenty of shade in the hot period, are most conducive to that development which ensures early action of the ovaries. By a proper system of feeding and management the lighter breeds should begin to lay from five to six months after they emerge from the shell, the heavier varieties requiring from six to seven months. The breeder should regulate his hatching accordingly, and it ought to be his aim to have the first batches in profit during September, and every pullet by November 1. It is an excellent plan to bring out a few lots of chickens in the autumn, in order to provide for the late summer of the following year, and not to be stranded during periods of such great heat as we have experienced within the last two or three years. In connection with this matter we must condemn the practice of breaking-off sitters which is often recommended. Hens do not always act in accordance with the wishes of their owners, and often become broody when hatching is not desired. But in experience it is found that if allowed to bring off a batch of chickens the hen obtains a needed rest, reducing the number of eggs produced when they are cheap, and reserving them for a time of year when they will be of much greater money value.

#### LAYING AT VARIOUS AGES.

That young birds are generally more fecund than aged specimens is a well-known fact. A French experimenter has stated that the ovaries of a hen contain the ova of about 600 eggs, and that it requires nine years to exhaust them. She will lay more than half by the time she is four years old, the number decreasing annually. In her eighth year only fifteen to thirty will be laid, and in the ninth year from one to ten. If this statement is correct, one effect of increased productiveness during the earlier years will be more rapid exhaustion of the ovaries, and such a suggestion is supported by experience. In this country the opinion usually held is that no hen should be kept beyond twenty-seven months, that is, she should be killed at the end of her second laying season. Some years ago I was interested in an experiment made to test this point, and it was found that twelve White Leghorns each produced 166 eggs within twelve months from the first laying, 135 during the second twelve months, and less than 100 during the third year. Doubtless had the test been continued the ratio would have declined each year correspondingly. Some American breeders claim that if the pullets are brought into profit by November 1, they should

be killed at the end of the first laying period, for thereby the higher rate of productiveness is secured, a much greater average being obtained. Also the hen when she has not passed through her first moult is of more value than she will be a year later, though it is doubtful whether she would command any more money on our markets in the first than in the second year. I am disposed to think that if hens begin to lay in October the American system is a wise one, at least for egg production, but, where they are not productive until January or February, it would be a mistake. Killed off in June or July, when there is a considerable demand for hens and at good prices, a few eggs may be sacrificed, but it is at the cheap season, and there is a great saving in the food bill. On many farms the absence of any regular method in disposing of the hens is productive of great loss. By a system of marking, the breeder should be able to know the exact age of every bird. The simplest method is to place copper or soft metal rings upon the right and left legs of the pullets in alternate years.

#### BREEDING *versus* BUYING.

Whether the farmer shall breed or buy his pullets must depend upon circumstances. In the majority of cases breeding will give the best results, as it is difficult otherwise to make that selection in stock which is desirable. But it is interesting to know of a plan which is followed in Belgium to a very large extent, and respecting which I made personal inquiries three years ago. Every year vast quantities of young pullets, estimated at 600,000 to 700,000 per annum, are imported from Italy, chiefly during the early summer, when they are from ten to twelve weeks old. These are of the Italian, or, as we should say, the Leghorn, type. They are purchased by Belgian farmers, who find that they lay earlier and better than the native breeds, and who keep them for a year, when they are fatted and killed, a fresh stock taking their place. I am a great believer in change of conditions. Darwin has suggested<sup>1</sup> that such a change often has the same effect as an infusion of fresh blood, and many breeders would support this opinion. Hence it is often found that transference from one set of conditions to another increases virility, and is a stimulus to productiveness, if carried out at the right period of life. This plan may open out a new field of enterprise. There are many districts, especially on poorer lands, where breeders might produce large

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<sup>1</sup> *Variation of Animals and Plants under Domestication*, chap. xxvii.

numbers of pullets for sale to farmers, who would be willing to buy them when the crops are gathered, if they could obtain the right class of poultry at reasonable prices.

#### SIZE OF HOUSES.

Reference has already been made to the place of poultry in relation to farming. Considerable indeed has been the change which has come over the minds of agriculturists during the last few years. Formerly only as many fowls were kept as could run about the homestead and farmyard. Beyond a limited number they would be a nuisance, and their habits would make a large stock troublesome in the extreme. During the last twenty years we have been engaged in the work of improving the class of poultry kept upon farms, and striving for better systems of management. This could only have been accomplished by an alteration of the method of housing. The adoption of smaller and portable houses is a distinct advance on the former plan. Fowls now take a place in the farm rotations, without displacement of any other stock or crop, and with a constant change of ground yield greater returns than before, their manurial value becoming an appreciable asset. They do less damage when scattered in small flocks than when massed in greater numbers. It may here be stated that the division of fowls into companies not exceeding, say, twenty-five, secures an increased average in egg production. Practical experience both at home and abroad is entirely in favour of this plan. If a hundred fowls be housed in one building with an allowance of twenty cubic feet of air space for each fowl, it will be found that they will not as a rule lay the same quantity of eggs as would be the case if divided into four flocks of twenty-five each with, say, an allowance of fourteen cubic feet of air space per fowl. Hitherto no satisfactory explanation has been suggested as to why this should be so, but the fact is indisputable. Later scientific investigations have proved that pure air is of supreme importance for every form of animal life, and these afford a clue to the solution of this problem. In a house measuring six feet by eight feet, an excellent size for twenty-five fowls, with a proper system of ventilation, if three perches are provided, only six fowls will be so placed that the supply of air when they are perching has to pass over the bodies of their companions. But in a large house, accommodating a hundred birds, with the same amount of floor space, about two square feet each, built twelve by sixteen feet, nine perches will be required, and thus out of the total, upwards of sixty of the inmates cannot obtain air which has not been vitiated by passing over the bodies, and

taking up the carbonic acid gas from the breath, of the others. Those on the inner rows must be in a much worse position in this respect than where there are only three perches. Small houses are also more portable than large ones, and all the evidence is in their favour.

#### PROTECTION.

Difficulties usually increase as developments take place, and poultry-keeping is by no means exempt from the operation of this general rule. With a wider distribution of the birds labour is increased, and if the stock maintained be considerable the business assumes a different phase. But this question of labour is by no means the most serious, though it cannot be ignored. To ensure effectual protection against enemies is the first consideration. There can be no question that in many districts the preservation of foxes has had a repressive influence upon the poultry industry, and such growth as may have taken place has been more limited than would otherwise have been the case. Poultry-keepers often suffer loss, greater than any compensation paid by the most liberally administered Hunt Fund. These funds are a great tax upon subscribers to the various hunts, and claims are frequently made which are clearly unwarranted, but, for the sake of peace, are seldom contested. Yet the entire question can be very simply solved by a proper system of housing. Recently I was discussing this subject with a gentleman who lives in a great hunting district, with covers all about his farm. He informed me that during the past five years he has only lost five fowls by foxes, and that was owing to carelessness. If the birds are shut up at night the losses will be reduced to a minimum, if not entirely obviated. But here comes in the question of labour. With a total of five hundred fowls, divided into flocks as suggested, twenty houses would be required, and, if scattered about the fields, to visit them all would take at least an hour. The farmer is, therefore, in this position. He must go round at feeding time, and either wait until the birds are fed, or pay a second visit to close the houses, if he does not wish to lose his fowls, provided the ordinary class of house is used. Excellent as is the portable house commonly sold, something more is required to afford protection, and also to minimise labour. The forms we are about to suggest can be used where foxes abound with perfect safety to the inmates, whilst they possess other advantages which will be obvious to farmers.

Whether the house used be on wheels, rendering it easy to move, or built in sections so as to be quickly taken to

pieces and transferred, does not really affect the principle. On pasture-land the former is preferable, for by frequent removal the grass is uninjured, and if the house is not fitted with a floor the manure can remain where it falls, to the enrichment of the soil. But on arable land the house need not be changed more than twice or thrice a year, either in connection with the rotation of crops, or when the ground immediately around the dwelling is becoming well charged with the droppings. Whatever the form, it is essential that there shall be attached to the house an enclosed yard or run, sufficiently large to allow the birds room to move about, and, at the same time, be protected completely from their enemies. This addition to the house need not be expensive, as will presently be seen. The cost will speedily be saved by reduction of the labour bill, and by prevention of loss, and its adoption will permit of the increase of poultry to an enormous extent in the most closely-

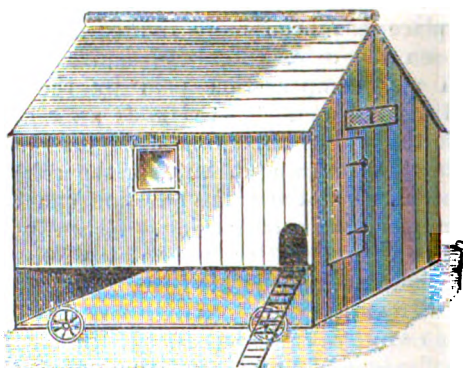


FIG. 6.—Portable House.

preserved districts, whilst claims upon Hunt Funds should be reduced to a minimum. Such losses as do occur might then legitimately be paid for at a rate more nearly approximating the real value of specimens taken than is now the case where good breeds are maintained. The illustrations (figs. 6, 7, and 8) will largely explain themselves; only brief descriptions, therefore, are necessary.

### SPECIMEN HOUSES.

Fig. 6 is an ordinary poultry house, which can be used with or without wheels as may be desired. It will be seen that the trap-door for the fowls is at the side, the house being 9 ft. long by 6 ft. wide. At the side should be placed a run 9 ft. long by 8 ft. wide, consisting of a stout wooden frame, upon which is fastened  $1\frac{1}{2}$  in. mesh wire netting at the ends and outer

side, that adjoining the house needing no netting. The end nearest the trap-door should be made to open. The frame should be at least 3 ft. high, and the top covered also with netting, or, what is better, made of wood covered with felt to afford a dry shelter beneath, in which case the attached run must be built as a lean-to, falling from 4 ft. 6 in. adjoining the house, to 3 ft. at the extremity. In these circumstances it will be desirable to make the roof of the run separate from the frame, attaching it to the house by iron spikes dropping into fixed sockets. A few catches will hold the covered yard firmly, and it will be detachable in a couple of minutes. Runs like this can be fitted to almost every kind of portable poultry-house used by farmers.

Fig. 7 is a very ingenious form of house, which has recently been introduced. It is removable without taking to pieces, as the run is firmly attached to the house. As shown in the illustration, it is mounted upon wheels, one at either side, and is so well balanced that one man can move it, using the cross-bar at the end of the run for this purpose. Two axle holes are provided for each wheel, one above the other. On even

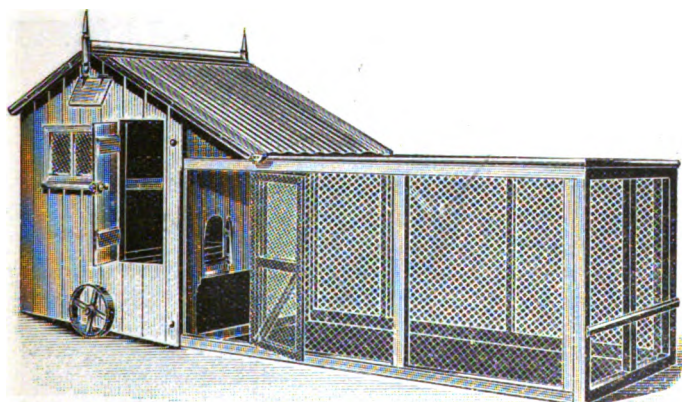


FIG. 7.—Portable House with Run.

ground the lower sockets may be used, as may be seen in the illustration, but on rough ground it would be necessary to raise the house by using the upper sockets. Shelter is afforded by continuing the roof in front over part of the run, and also by the space below the floor. The latter arrangement I do not like in a fixed house, but when often removed it is not so objectionable. A sliding floor is fitted to facilitate cleaning. The house is well lighted, satisfactorily ventilated, thoroughly well planned, and complete in all its details.

Fig. 8 represents a house built on what is known as the scratching-shed plan, and is from a photograph of two houses which were first exhibited at the Royal Agricultural Society's Show at Birmingham in 1898. This form is best adapted where it is not intended to be removed, but on a smaller scale it can easily be taken down and re-erected, if built in sections. The idea is American, but a few alterations have been adopted to suit British conditions. Fig. 9 gives the ground plans of a modification which I have recently adopted for special reasons. By the use of detachable wheels and shafts, houses of this class could be made portable without taking to pieces. The notes given below indicate the respective sizes.

Additional to the roosting compartment, which is lighted by a large window in front, is a scratching-shed, under the same roof, the latter fronted by a screen of wire netting, so that when the door is closed the birds are completely protected and sheltered from snow and rain. The term "scratching

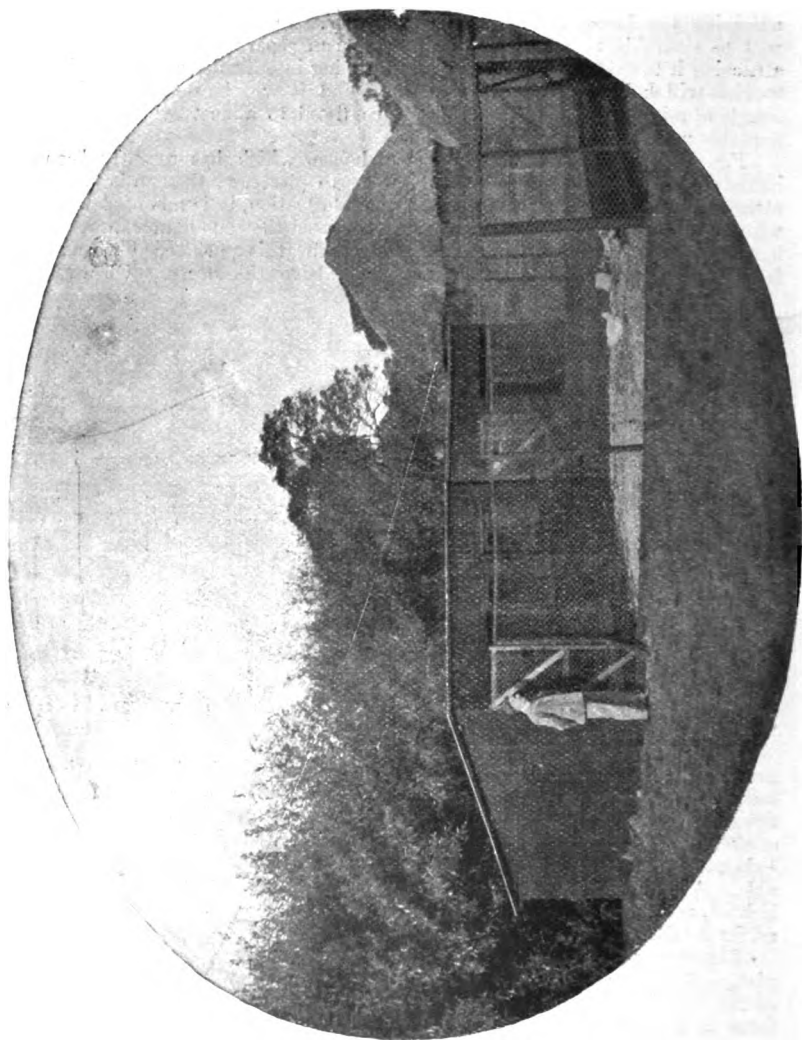


FIG. 8. - House and Scratching-shed.

shed" is employed because the floor of this covered run is in winter littered with straw, dried leaves, or cut chaff, amongst which the corn is scattered so that the birds obtain exercise in seeking for it. The compartments provided are a roosting place, a scratching shed, and a separate place for laying, which is a great acquisition.

All the forms of houses which have been recommended, portable and permanent, simplify labour and afford complete protection, whilst it is obvious that the shelter during unfavourable weather is a distinct gain. It has frequently been observed by farmers that, when fowls are nightly shut up in the houses ordinarily employed, two journeys must be made in the evening—firstly, to feed; and secondly, after they have gone to

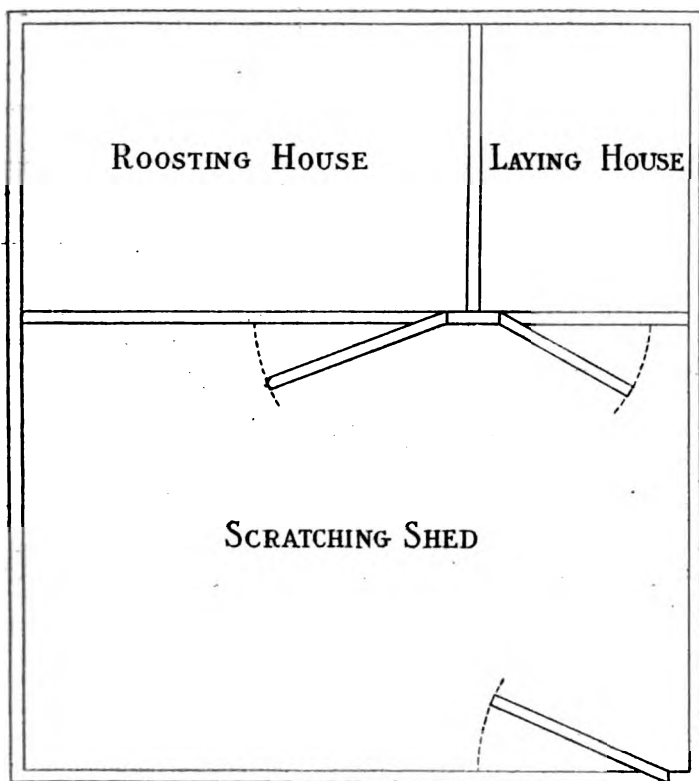


FIG. 9.—Ground Plan of Scratching-shed House: total width 9 ft., depth 10 ft. Roosting House, 6 ft. by 4 ft.; Laying House, 3 ft. by 4 ft.; Scratching Shed, 9 ft. by 6 ft.

roost, for closing the trap-door, whilst an early visit must be paid in the morning to liberate the inmates, who are unhappy if confined beyond the usual time. The necessity for this is obviated by the use of these run attachments or sheds. In the evening the fowls are fed within the enclosure, and the door is then fastened. Next morning they can come into the run as soon as they think fit, enjoying the morning air, and escaping from

the roosting compartment. The scratching-shed houses may be employed for intensive poultry-culture, by the addition of open yards laid in gravel or sand, and long grass runs, by means of which that taint of the ground, which is the *bête noire* of the poultry-keeper who wishes to restrict his fowls within confined areas, can be obviated. In fig. 10 is given a ground-

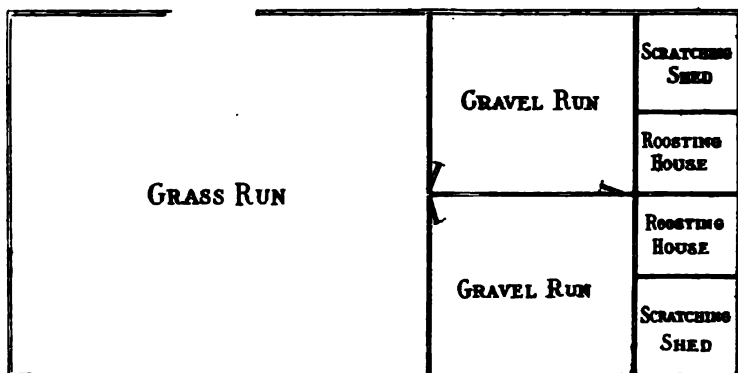


FIG. 10.—Ground Plan of Double Scratching-shed Houses and Runs. Gravel runs, each 9 ft. by 20 ft. square; grass run, 100 ft. by 18 ft.

plan of houses and runs built and laid out on this system, which promises to revolutionise the poultry industry in this country, as it already has done in America, and to bring it within the scope of those who are not farmers. It is practically an application of the soiling system to poultry-farming, and is worthy the attention of those who are occupied in egg-production.

#### HATCHING AND REARING.

In these days it is unnecessary to advocate the use of artificial methods of hatching and rearing. Incubators and brooders are as necessary to the progressive poultry-keeper as are separators to the dairy farmer. But for their successful introduction the increase of poultry-keeping in this country would have been very much less than we find to be the case. Multiplication of varieties which are either non-sitters or have a lesser tendency to broodiness than their predecessors, and the demand for earlier hatching, have caused artificial incubation to become an important factor in this industry. The more eggs a hen lays, the longer will she be ere the desire to form a nest is manifested. So that, with a greater demand, there is less chance of providing for it under the natural method. The better plan is to adopt both systems. Employ hens when obtainable, but do not depend upon them alone. Incubators should be relied upon

when hens are unavailable. These appliances are essential where non-sitting varieties are kept, as broody hens are generally scarce and dear when most required. If autumn and winter rearing is attempted, incubators and brooders must be employed. Later on the hens will come into use, and are to be preferred as rearers during the warmer months of the year. With a large number of hens sitting at one time a special house should be devoted to them. Space does not permit of my going into detail descriptive of management and feeding, but this information can be obtained elsewhere.

### PIONEER WORK.

This country is much behind others in experimental work, and such observations as have been made lack completeness and consistency. In no branch of the live-stock industry is this more evident than in poultry-keeping. The public spirit and liberality of wealthy men have afforded valuable information respecting the feeding of the larger domesticated animals, yet with these much remains to be done. So far as poultry are concerned, scientific investigation is an untrodden field. Work of this nature is costly, requiring to be conducted over a long period of time, and those who have hitherto interested themselves in poultry have not been able to undertake it. As it is, we are without reliable data upon which to depend. Such knowledge as we possess has been gained either by practice or by inference from observations respecting other animals. Much more has been done in North America, but the results are not always applicable to our own conditions. The subject is too large to be dealt with in a paper such as the present, and I can only suggest a few points for the consideration of poultry-keepers.

### FOOD AND FEEDING.

In considering the food for domestic poultry, we have, in the case of hens, not only to supply the elements required to sustain the body and provide the combustible matter, but to insure sufficient material to form the eggs. As prolificacy increases, so must these various materials be enhanced in quantity. The average percentage composition of a fresh egg, exclusive of the shell, is as follows:—

Water	.	.	.	.	.	.	.	.	.	74.0
Albumin	.	.	.	.	.	.	.	.	.	14.0
Oil or fat	.	.	.	.	.	.	.	.	.	10.5
Mineral salts	.	.	.	.	.	.	.	.	.	1.5

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100

Hence, if we take 2 oz. as the average weight of an egg, for every 10 produced, a hen gives forth, in this form,

Albumin . . . . .	2·8 oz.	Mineral salts . . . . .	0·3 oz.
Oil or fat . . . . .	2·1 „		

which she must obtain either from food or from the reserves within her body. As the albumin is the more abundant, the supply of nitrogenous matter must be greater than that of oil or fat, but the difference is not very great between the two. It will be found that the albuminoid ratio should be from 1 : 4½ to 1 : 5, according to the season of the year; more of carbo-hydrates are needed in winter than in summer. By studying the analyses of foods commonly supplied to poultry it may be seen whether they are suitable or otherwise. Let us take the analysis of oats as an example (fat, 6·30; carbo-hydrates, 57·17; albuminous compounds, 13·06 per cent.). "Here the percentage of fat is 6·3, which, multiplied by 2·3, gives 14·49. Add to this 57·17 for the carbo-hydrates, and the sum is 71·66. Hence the albuminoid ratio in the case of oats is 13·06 : 71·66, or 1 : 5½."<sup>1</sup>

It is at once evident that several grains which are commonly given to poultry are unsuitable if fed alone. As examples we mention beans, peas, maize, rice, and bran. Blended with other grains, &c., in which the excess or deficiency of elements is counterbalanced, each may be employed, and for this reason the use of any one food is a mistake. Fowls under domestication are fed almost entirely upon grain or grain products, because they are digestible, but under ordinary conditions fibrous foods, such as hay, cannot be used, for "birds have apparently no power of digesting vegetable fibre; the food passes too quickly through the system for the fibre to be attacked."<sup>2</sup> Hence hay is useless unless it is cooked. In America clover hay, which is rich in nitrogenous substances, is found very valuable for egg production, and is extensively employed as poultry food, but it must be cooked. There can be no question that cooking food is true economy, and that the system adds greatly to the variety which can be provided for fowls. Of late years appliances have been introduced which make the labour of cooking easy, and the system is one that is calculated to reduce the cost of feeding and increase the return in egg production. Certain meat products are valuable for poultry if given in suitable quantities, and especially during the winter months. A further point in connection with feeding

<sup>1</sup> *Elements of Agriculture*, by Dr. Fream, p. 381.

<sup>2</sup> *Chemistry of the Farm*, by B. Warrington, F.R.S., p. 124.

can only be mentioned, namely, that throwing food down upon the ground is very wasteful. The tendency of all poultry-keepers is to give too much food. But the most serious adverse result from this very general system is that the food is trodden into the ground, where it decomposes or becomes tainted with the excretions, and disease ensues when it is consumed by the birds. Feeding from troughs is not only more economical, because what remains after the birds are satisfied can be removed, but it also avoids the risk mentioned.

#### MARKETING.

When we consider the question of marketing, it is at once found that there is very great irregularity in supplies of home produce.

Much has been said as to middlemen, and, whilst there is often a tendency for a trader to become master instead of remaining servant of the producer and consumer respectively, he is a necessary factor in our modern conditions of life. Direct contact between farmer and householder is only possible to a limited extent, beyond which the system can scarcely be expected to develop. Buyers prefer to have a choice; what is suitable for one is either too costly or not good enough for another. The trader classifies the produce in accordance with the requirements of his customers, and is thus able to pay a higher average price than would otherwise be the case. The difficulties attendant upon this question I have previously discussed to some extent, and refer the reader to an article published a couple of years ago.<sup>1</sup>

#### RAPID SALE ESSENTIAL.

Not only is it necessary to secure a supply of eggs in winter, but there must be rapidity in marketing if home produce is to command and hold the first position both as to demand and price. A fresh egg has a flavour which cannot be retained beyond three or four days, after which it rapidly degenerates. No foreign egg can be sold in this country in its pristine condition, and it is for this reason that British producers ought to be able to obtain higher rates than their rivals abroad. There should be no difficulty, if the trade were organised, serious enough to prevent English eggs being in the hands of traders within forty-eight hours of being laid. But,

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<sup>1</sup> "The Marketing of Poultry," *Journal R.A.S.E.* 3rd Series, Vol. IX. 1898, p. 270.

with this object in view, present methods must be changed. Dependence upon weekly markets, or upon carriers, means that the eggs come into competition with French and Danish, instead of being far above them in respect of quality and freshness. Sentiment would lead us to prefer an English to a French egg, but the trader must look at facts. If the latter is as fresh as the former, and can be bought at a lower figure, his interest leads him to purchase where he can secure the greater return for his labour and enterprise. Only by giving him an egg which he is able to sell at a higher rate can the home producer expect a better return. In too many cases it is not so fresh as the best qualities of foreign, is not so reliable, is uncertain in supply, arrives in dribblets, is not packed with the same care, and is not graded or sorted. The retention of eggs until they are no longer fresh, explains why in many rural districts they command so low a price during the spring months. They have to compete with the second and third grades of foreign supplies, and are often in no way superior.

#### PRICES OF EGGS.

In some of our Southern counties eggs are sold in the months of March, April, and May at 18, 20, 22, and even 24 for 1s. It is of interest to compare prices with those in similar districts abroad. Mr. C. Conway Thornton, Her Majesty's Consul at Budapest, Hungary, writes me, under date of April 19, 1900:—

The official Hungarian Statistical Returns for 1898 give the average price of eggs as varying between 566 heller (4s. 8d.) and 354 heller (2s. 11d.) per *hundred*, according to the locality. In this town the price was 538 heller (4s. 5d.) = 5 kronen 38 heller, or 2 gulden 69 kreuzer. A friend informs me that the average price of eggs to-day is usually calculated by housekeepers at 40 kreuzer 80 heller (8d.) for *sixteen*; this represents exactly 5 heller apiece (instead of 5·38 as above), or one halfpenny. Purchased wholesale, this amount may be reduced to 30 kreuzer, or 60 heller (8d.) for the sixteen. The foregoing are country prices, but I understand that the difference between these and town prices is very trifling. . . . During the past thirty years a steadily increasing attention has been paid to this subject throughout the country. Since the year 1874 numerous exhibitions of poultry have been held in the capital and in provincial towns, including an international exhibition at Budapest in 1885. A Poultry Fanciers' Association exists since 1886, and does much to encourage improvements in breeding. The Ministry of Agriculture also devotes funds to the same purpose, providing selected birds for breeding in the principal centres, and despatching lecturers upon circular tours. The conditions existing in Hungary are admirably suited for poultry breeding upon an enormous scale; and there can be little doubt that the efforts now being made will eventually prove highly remunerative.

Mr. A. P. Tomassini, Her Majesty's Vice-Consul at Ancona, Italy, writes, under date of April 24, 1900 :—

The villages from which the eggs are exported are named *Fano*, *Monte Marciana*, *Jesi*, *Porto Civitanova*, *Tolentino*, and *Castignano* ; however, those italicised are small towns, with inhabitants varying from 12,000 to 15,000 each. The cost prices are now about 56 Italiano lire (48s. 7d.) per 1,000 eggs of an average weight of 54 kilogrammes net. These prices vary in accordance with the season and market fluctuations. The exports of eggs from this district amount to about 50,000,000 per annum ; of these two-thirds are forwarded to the London markets and the remainder to Switzerland and Germany.

Mr. C. T. Malling, Her Majesty's Vice-Consul at Aalborg, Denmark, writes, under date of April 26, 1900, that "the price at present in the villages is 33 ore (4½d.) per Danish pound, unassorted but fresh eggs." As the Danish pound is sixteen ounces troy, if we take eggs weighing sixteen pounds avoirdupois per long hundred, this will give nearly 7d. per dozen eggs in April. Thus we find that the prices were last April higher in Denmark than in many parts of Great Britain, about the same in Italy, and very little lower in Hungary. Last year I found that the retail prices of eggs in St. Petersburg were not very different from those obtainable in London. Such facts should emphasise the contention that farmers and others sacrifice the advantages they possess of contiguity with the point of consumption.

#### METHODS OF IMPROVEMENT.

How is the revolution of our methods to be achieved? In most of the supplying countries commercial enterprise has organised the collection and marketing of eggs. But in Denmark this has been accomplished by means of Poultry Societies upon a co-operative basis, with a central Association, formed in 1895, which last year had 345 branches and a membership of 18,500.<sup>1</sup> This Association by its ramifications at home and abroad has done much to advance the Danish egg industry. In Ireland the Irish Agricultural Organisation Society is following on similar lines, with a considerable measure of success. Whilst, therefore, commercial enterprise might, if it were attempted on an ambitious scale, do much to develop the trade, if the main idea is to assist producers co-operative effort would yield better results. With this end in view the National Poultry Organisation Society has been

<sup>1</sup> An account of these Societies was given in the *Journal of the Board of Agriculture* for June, 1899.

formed. There are those who declare that British farmers will never combine for mutual benefit, that their individuality, their suspicion of one another, their jealousy, will wreck any attempt at combination. That remains to be proved. It is worth a trial, for what can be done in Denmark and in Ireland should not be impossible in Great Britain. As a protective measure it has been advocated that the Merchandise Marks Act should be applied to the individual egg and not only to the case in which it is packed. The latter Society named seeks to accomplish the same purpose by stamping the guaranteed new-laid British egg, which appears to us the preferable method. That there is a great deal to be done ere home eggs secure the rank and price they might command is unquestionable. Producers have much to learn and unlearn. It does not mean that because an egg is encased within a shell it is not perishable, as many appear to imagine. Producers are careless in many respects. They allow eggs to remain in the nest for hours after they might have been collected; perhaps a hen is sitting upon them all the time, and incubation thus commences. They send eggs out which, to say the least, are doubtful. The plan in autumn of holding for a rising market is foolish in the extreme, but it is very common. Buyers cannot trust even home eggs at that season of the year, and many of the largest retailers are compelled to test every egg before it is sold. To gain the confidence of traders every egg should be tested, either by the producers, or, as in Denmark, at the branch where they are packed, and only those forwarded as new-laid which are really fresh, the others being sold as "cookers." This testing is very simple. The external appearance, the aspect of the contents through the shell, and the size of air-space indicate the age of the contents. The method of testing is by means of a small lamp, with strong lens, in a dark room. If the egg is held against the side tube, the light shows clearly its condition.

For those who operate upon large quantities of eggs a patent has recently been taken out by the Lyons Egg Testing and Grading Machine Co., of Manchester. A man standing in the cabinet can test a case of eggs (1440) every three minutes. Smaller testers are sold by the same firm for 12 and 30 eggs respectively, and these are used in full daylight. The question of grading is also of great importance. Eggs look bigger and sell better if they are all the same size, and no margin is needed for "smalls." They also carry much more safely in transit than when of various sizes. Fig. 11 shows the Lyons Grader. The Danes have brought this system to a state of perfection, and eggs weighing from 13 to 18 lb. per long

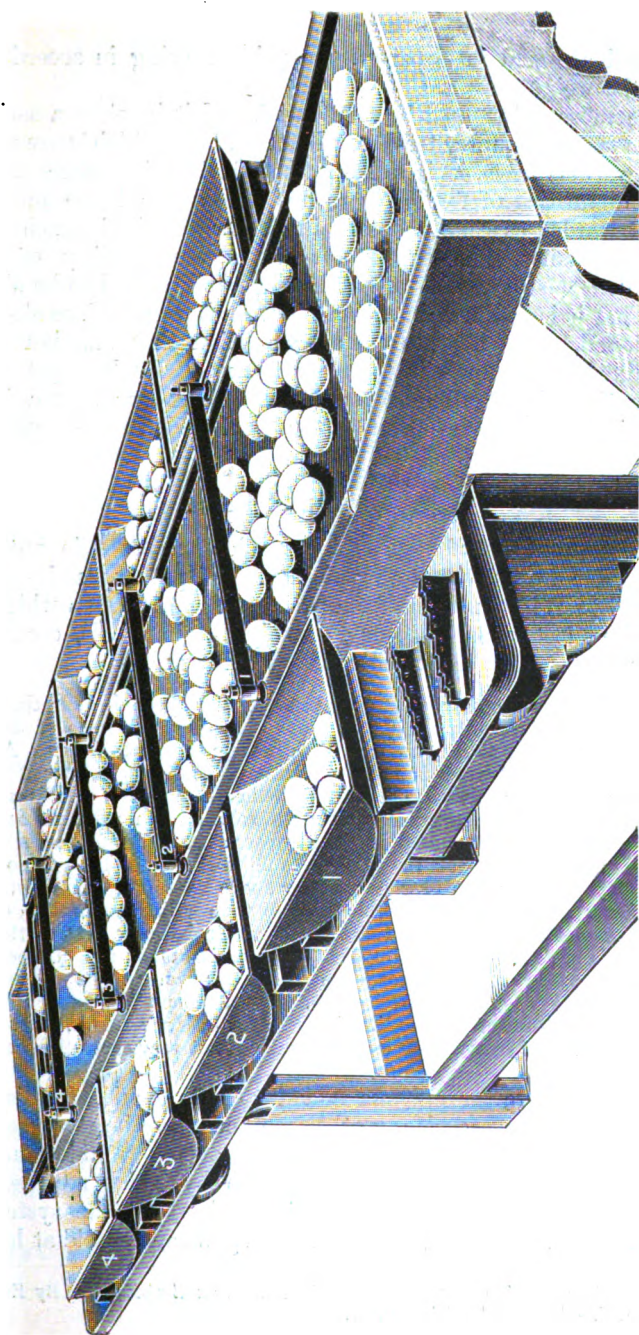


FIG. 11.—The Lyons Egg Grader.

hundred are sold in six sizes, the price varying in accordance with the weight.

One more point must be mentioned, and it involves a serious charge against country traders. From evidence which has reached me in various ways, it is evident that during the scarce season large quantities of foreign eggs are mixed with home produce and forwarded as English new-laid. The practice is much more general than I had thought, and firms are guilty of this fraudulent custom which might have been expected to be above it. That it is common in Ireland is well known, and, as already mentioned, there is more than a suspicion that Russian eggs are mixed in Denmark in the same manner. Such a system is destructive of all confidence, and must be stopped, even if in the doing so we have to destroy the local trade in every part of the country.

#### PRESERVATION OF EGGS.

Vast quantities of eggs which reach our shores in autumn and winter are preserved or "pickled." A patent was long ago granted to William Jayne for a process of preservation which is still the most popular to-day, namely, by lime, salt, cream of tartar, and water. The method is as follows :<sup>1</sup>—

The eggs are placed in tubs or vats as soon as possible after they are obtained from the poultry-keepers. Some vats hold hundreds of dozens, and are kept by dealers who buy them in from the fowl-owners. A preparation of lime and water is made by mixing about twenty gallons of water with four gallons of fine slaked lime, to which a gallon of salt is added. When the water appears to have taken into solution as much lime as it is capable of holding it is poured over the eggs so as to completely cover them, and it is usual not to pack the eggs quite up to the top of the vat, so that there may be two or three inches of water above the top layer. It is, however, found necessary to add from time to time a little more lime, or by keeping a cloth of lime on top touching the water, in order that as that in solution is absorbed, or loses its effect, more can be taken up. Unless this is done the preservation will not be successful, for water alone will not be sufficient to keep eggs in a fresh state. The same end can be secured by throwing a handful of the fine lime into the vat every few days, but this is a rougher method, which may lead to trouble if not very carefully done.

Cream of tartar may be added to the pickle, but is not absolutely necessary. Many other methods have been suggested, but the majority are either too costly or too troublesome. I have never, however, met with a system by which a preserved egg can be kept equal to new-laid, and whilst the system is valuable and profitable, because these eggs can be sold at higher

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<sup>1</sup> *Poultry Keeping as an Industry for Farmers and Cottagers.* By Edward Brown, F.L.S. Third edition, p. 87.

prices in the winter than in the plentiful season, they ought always to be vended for what they really are, and not as fresh eggs. To secure the best results, preservation should be done by producers and not by traders, as the condition when taken out will depend upon the age when put into the pickle. A fresh egg preserves better than one a week old. Eggs should be infertile for this purpose. Nearly twenty years ago I arrived at this conclusion,—though the fact had been known in ancient Italy as stated by Columella,—as a result of observations made in connection with the Preserved Egg Class at the Birmingham (Bingley Hall) Show. Last year an experiment conducted at the Ontario Agricultural College, at Guelph, Canada, proved that infertile eggs after four months were distinctly superior to those which were fertile. And, further, whatever the method of preservation, a low temperature assists the work; but, apart from the danger of cracking the shell, freezing is not recommended, as it is stated that in a frozen egg a fungus is developed which injures it as an article of food. Upon this point, however, our information is incomplete.

#### CONCLUSION.

In conclusion, reverting to the production of eggs, whilst claiming that much has been done to increase prolificacy in the fowls met with upon the farms of Great Britain, we have not reached the limit in this direction. The time has arrived when progressive breeders must seek further to extend the egg production, and therefore the profit derivable, from individual hens. This can only be accomplished by records of production as in milch cows, and by breeding from those birds yielding the best results. In America it is claimed that averages of 180 to 200 eggs per annum have been secured throughout large flocks. This means labour, but profitable labour, with speedy results. By separate laying compartments, as in fig. 9, and use of traps so that when a hen enters she cannot get out again until liberated; also by numbering each hen, and recording her performances, the bad layers can be weeded out. Poultry-keepers must aim at securing a profit of at least 5s. per hen per annum, and this being attained, industry will become a more appreciable factor to the British agriculturist.

EDWARD BROWN.

*The Chestnuts, Theale, Berks.*

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## ASPARAGUS CULTURE.

### I. IN THE FIELD.

FOR soil, a thoroughly good deep yellow loam, well drained and with a warm subsoil, is what is required; a kind of tilthy soil, which will not bake or crack, either wet or dry, and which will work in any sort of weather. It should be in as early a situation as possible, quite open to the south, and if sloping in that direction it will be all the better. A cold backward position will not do under any circumstances.

The soil for asparagus must be deeply stirred two feet at least, and deeper if practicable, as to endeavour to grow good asparagus on shallow soil is to court failure. In addition to deep digging, heavy manuring will also be necessary—in fact, the more generous treatment the crop receives the more satisfactory will be the result.

The way in which the deep cultivation is to be carried out would probably be best decided upon the spot. It would most likely be done at the cheapest rate by a steam plough and cultivator, or by ploughing two furrows deep with horses. Where it is possible by either of these means to move the soil two feet deep, the top soil must be turned underneath, and the bottom spit be brought on to the surface. As the work proceeds, a dressing of good farmyard manure at the rate of twenty tons to the acre should be put on, and turned in between the top and bottom spit. Top-dressings of soot and salt are very useful a few times during the summer, and bone meal and kainit may also be used with advantage.

If it should be found impracticable to effect the deep cultivating with horses or steam-power, the alternative would be with the spade; this would certainly be the best way, as the ground would be more thoroughly stirred than by any other means, the only objection to it being the extra expense. Double digging would cost from 8*l.* to 10*l.* per acre, according to the soil and the price of labour in the locality.

The land must thus be prepared in the autumn, so that it may have the benefit of the winter's frost, &c., and be in good workable condition at planting time.

As to the kind of asparagus to grow, fortunately there are not very many varieties, and "Reading Giant" or "Connover's Colossal" will be safe sorts to plant; though large heads are the result of good cultivation rather than of the variety grown.

Planting may be done either by sowing the seed where it is to remain, or by using plants which have been raised elsewhere. If seed is employed, from the middle to the end of March would be the right time to sow; and, if plants are used, the first week in April would be suitable, as the plants are much more likely to do well when they are beginning to grow than when they are dormant. Autumn planting should never be practised. To sow seed is preferable to using plants, as by this means the plants grow straight away from the first and have no check. The one drawback to sowing seed is that there will be one year longer before cutting can begin. The objection to using plants is that they always suffer in transplanting, and in no case should plants of more than one year old be used. The plants should stand singly in rows—three and a half feet from row to row, and nine inches from plant to plant; as by this method of planting more of the ground can be kept clean with the horse-hoe than when it is planted in beds of several rows in each. Where seed is sown the plants must be thinned out as soon as they are large enough. At the time of sowing or planting, stakes should be set up at the ends of each row as a guide for the horse-hoe, which will probably be required before the plants are visible. In using plants, a trench must be cut by a line, of sufficient depth to receive the roots comfortably in a natural position, leaving the crown one inch below the surface.

If any plants fail a stick should be placed in each gap, and these gaps should be carefully filled up with one-year-old plants the next April. Never in any circumstances should plants be put in with a dibbler, as to crush the roots up is the first step towards failure. As soon as the plants are visible, or before, if necessary, the horse-hoe should work the spaces between the rows, and the rows of plants or seedlings should be carefully hand-weeded. The stakes at the ends of the rows should serve as a guide to keep the horse-hoe off the rows of plants; but as asparagus seed takes some time to germinate, it is a good plan, where sowing is adopted, and especially when the rows are long ones, to drop a few radish seeds at intervals of a yard or two in the drill with the asparagus seed, as they will soon be up and distinctly mark the row. The surface must be kept stirred between the rows, and, if seedlings, they should be thinned out to nine inches apart. The plants must be kept quite free from weeds.

As no return can be taken from the asparagus for the first two or three years, it is quite permissible to plant a row of potatoes along the middle of the three and a half feet space between the rows—some small-topped variety, such as “Puritan”

or "Sutton's Early Regent." By this means sufficient money should be made to pay a good rent and all working expenses, and with a "change of seed" the same plan might be practised the second year with satisfactory results.

When the asparagus has made its season's growth, and the tops begin to turn yellow, at about the end of October, these should be cut off and cleared away, the soil lightly forked a foot on each side the row, and then about three inches of earth put over the row, making a raised bed of about two feet wide. This could be done with the plough, taking a shallow furrow on each side and turning to meet each other on top of the row, and could be broken and levelled with a fork, if necessary. It is important that this work should be done in good time, so that the soil may have the full benefit of the winter's frost.

The second season's work must begin early in March, by carefully forking over the surface of the beds (the soil which was put on in the autumn). This must be done not too deep, and so as not to risk injury to the crowns of the plants. The workman should stand by the side of the row, *not upon it*, as it is very desirable to keep the surface over the roots as light as possible. After the forking a slight sprinkling of salt may be given and repeated two or three times during the summer. Crops of potatoes may be taken as in the first year.

The work during the second summer will consist in keeping the ground quite clear of weeds, and if the surface is at all inclined to cake it should be carefully forked about the plants. Towards the end of October the tops should be cut off, and the ground well forked over, always being careful not to injure the crowns. The beds should now have a dressing of manure, which should be covered up with soil; this will have to be done with the spade, and enough should now be put on to raise the beds another three inches, thus making the crowns some six or seven inches below the surface, and giving about the necessary length of white. Asparagus for market is liked white about three-quarters of its length.

The work of the third season will commence with carefully forking over the beds, which should be done early in March. The surface must be left fine and even so that the heads may be able to easily push through.

The time that cutting will commence must of course depend upon the season. About the middle of April would be the average time, though, in some seasons, there would be hardly any through before May. It should begin as soon as any heads are one and a half or two inches above the surface, and cutting all, both large and small, with a proper asparagus knife—a saw-

edged one—as this kind of knife does not injure other crowns as a sharp cutting one would. The knife has a saw-edged blade about four inches long, with a handle of twelve to fifteen inches. The way to use it is to pass the blade down close by the head intended to be cut until the crown of the root is felt, then, by a dextrous twist sideways, detach the stem from the root. An experienced man should be employed for this work, as a number of shoots are always rising at the same time in different stages from the same spot, and a careless cutter might destroy a great many heads.

It is most important to keep the cutting well in hand. No hard and fast rule can be laid down about it, beyond that it must be done at the proper time. Two inches above ground is quite enough of growth, as, if longer, the plants begin to run, and spoil their appearance for market in a few hours, for as asparagus grows in length the heads lose their plumpness and get thinner. It is only those who are accustomed to seeing asparagus growing who can realise how very quickly, in hot weather, a whole cutting might run away; therefore, at this period, it is important to have practical and trustworthy men, as at times in mid-season it will be necessary to work early and late to keep pace with the growth. Two inches above ground with about six inches below (which will easily be obtained if the roots have been earthed up as before directed) will be a good average market length.

The man who is cutting will pick up the heads one by one as he cuts them, keeping them straight, with the tops all one way, until he gets a handful; he will then lay them down upon the bed, and thus he will proceed until the whole breadth is gone over. When the cutter has got a little in advance, a man must follow him with a basket or hamper and collect all the cut heads, keeping them straight, with the crowns, as before, all one way. They must then be taken away to be washed and tied ready for market. Women will do this work more cheaply than men. There must be a shed or building on the ground, with a good supply of water. The best method of washing asparagus is to put a lot at a time into a large tub with plenty of water, and give it a good swilling about—this will usually clean it. It must now be taken out, laid upon a table, and sorted into two sizes. All the small, which is called “Prue,” is tied in bundles by itself, and the best, which should be about the thickness of a man’s little finger, tied in bundles of six scores in each. It may be tied with willow withes, or with good matting, or raffia, or cuba bast. Whatever material is used it must be strong enough to bind safely. The bundles must be made flat, not round.

They should be about seven inches wide and about four inches through, or larger or smaller, according to the size of the asparagus.

The usual method of tying was to first tie each bundle in six small bundles of one score each, called hands, being careful to place the best heads on the outside of each bundle; then lay two bundles side by side with tying material under them, lay two others on top, and one other on each side right and left, always keeping the best side outwards; now bring the tying material round, draw as tight as possible and tie fast, and the result is the flat bundle before described. By this means very good looking bundles can be made. It is quite impossible to get all the heads the same thickness, hence the importance of keeping the best heads outside, as there is no cheating in making the same thing look its best; and the difference between tying carefully and tying anyhow would make from ten to twenty per cent. difference in the selling price.

A newer and more expeditious method of tying than the above is to tie the whole six scores at once. To do this there must be two small pieces of thin board fixed edgeways upon the table for the purpose of holding the asparagus in position while the tie is passed round it. The boards must have a cut in them down to the table in which to lay the tying material, and willows would be best to use now. Two ties will be necessary by this plan, as otherwise the bundle would not keep flat. A small one should be laid down first in the middle of the frame, lengthwise of the bundle, the same way that the asparagus lies, then place across that, and in the cuts before mentioned, the withe which is to go round the bundle. The small willow should now be bent, and its two ends brought upwards, forming a loop below the tying willow. The six scores must now be counted and laid straight and neat in the frame, keeping the best outside as far as possible, and placing about half on each side of the two ends of the withe which now sticks up through the bundle. Now bring the tying willow round between the two ends of the other willow, draw tight, and tie fast, still keeping the bunch in the frame; then take the two ends, press the bundle flat, and tie them round the top willow, thus holding the two sides of the bundle together, and keeping it flat. By this means a good looking bundle can be made, and much more quickly than by tying in separate scores; but it is quite necessary to use one willow to go through the bunch, or the latter would get loose and would not keep flat. Each bundle when tied should have the bottom end trimmed with a sharp knife to take off any ragged or uneven ends.

Fairly good asparagus 8 in. long would weigh  $3\frac{1}{4}$  to 4 lb. to the bundle, and that would be a good average size for market.

I have heard of a bundle (six scores) weighing as much as 28 lb.; but this would be obtained by selecting the very finest heads, one here and there, placing a drain-pipe over each, filling the pipe with soil, and letting the asparagus grow through it, and then cutting it about two feet long. Sixty heads, 9 in. long, have been known to be cut weighing  $7\frac{1}{4}$  lb.; the very best out of a cutting of 10,000.

After the bundles are tied and finished they should have a good swill through clean water before packing for market.

The best baskets to pack in would be common bushel flats with lids, these would each hold 8 or 10 bundles; they should be placed butts to end of basket, and crowns towards each other in the middle. The flats would be large enough to take two bundles in length, with a little long green grass or soft nettles between them in the middle to prevent the crowns from getting injured.

Covent Garden, London, is the best market for good asparagus. The price per bundle will vary from 9d., or even less, to 3s. 9d. or more; but in a plentiful season it would not be safe to expect it to average more than about 1s. 3d. "Prue" would make about 6d. per bundle. The produce per acre would very much depend upon the season and the weather. In some seasons cutting will begin early in April; while in another year there will be very little before May, and this of course would make all the difference in the number of heads, which in all probability would be somewhere between 50,000 and 150,000 per acre.

Cutting in all cases should cease by June 21, or, better still, by June 15, as the life of the plants depends more upon this than anything else; as it is a strong, vigorous growth, made after cutting is done, which prepares crowns for the following season.

## II. IN THE GARDEN.

For the cultivation of asparagus in gardens the ground must be prepared in the same way as described in the early part of this article, and be trenched with the spade, the situation being open and warm.

The most convenient size for beds is three rows wide, with the rows nine inches apart, and one foot from plant to plant, and any length that may be desired.

The beds may be planted either by seeding or by planting one-year old plants in the manner before directed, but three rows together instead of one. The space between the beds should be five feet, as more soil will be required to earth up the three

rows than the one as described in field culture. The space between the beds may be utilised the first two years by growing onions, potatoes, lettuces, or almost any crop that does not grow tall.

The cultivation as to cleaning, etc., must here be carried out as before directed, except that, as horses cannot be used, the hoe and hand-weeding must do all. Earthing up at the end of the first and second years must be done to the same depth as in single row culture, but all with the spade.

The beds should be made up with soil quite one foot wider than the outside row, or otherwise the roots and crowns will spread and come through the side of the bed. The manuring, cutting, and after cultivation must all be done in the same way as for the one row plan. It is most important that the cultivator should not walk upon the beds, hence the reason for three rows only, as that width can easily be reached half from each side without placing the foot upon the bed. If beds are inclined to get hard during cutting time they should be very carefully forked over. Cutting should always cease by the third week in June, or by the middle, if asparagus is not much in demand, as the longer time it has to grow the better it will be the next season. When beds have been cut a number of years and show signs of weakness, they should be given a whole year's rest—not cut at all. This will often add several years to their life.

### III. IN THE GREENHOUSE.

If it is desired to have a supply of forced asparagus in the winter and early spring, it may easily be obtained if a greenhouse is available in which a temperature of 65° F. can be maintained. The best plan is to place good four-year old roots (which have never been cut from) close together upon three inches of soil on a well-drained bottom. Cover with four inches of fine soil, keep a bottom and air temperature of about 65°, water when necessary, let it have full daylight, and ventilate regularly. Be careful not to get too high a temperature, as that will make a spindly growth; 60° to 65° is safe, and with that the asparagus should be fit to cut in about six weeks from the time of putting in. Roots may be put in in batches, say every fortnight or three weeks, and a supply thus kept up until the outdoor cuttings come in.

Roots grown expressly for forcing, in the way directed in the single row plan at the beginning of this article, only *not earthed up*, might be used the fourth or fifth year, not cut from before forcing.

JOHN J. T. NORFOLK.

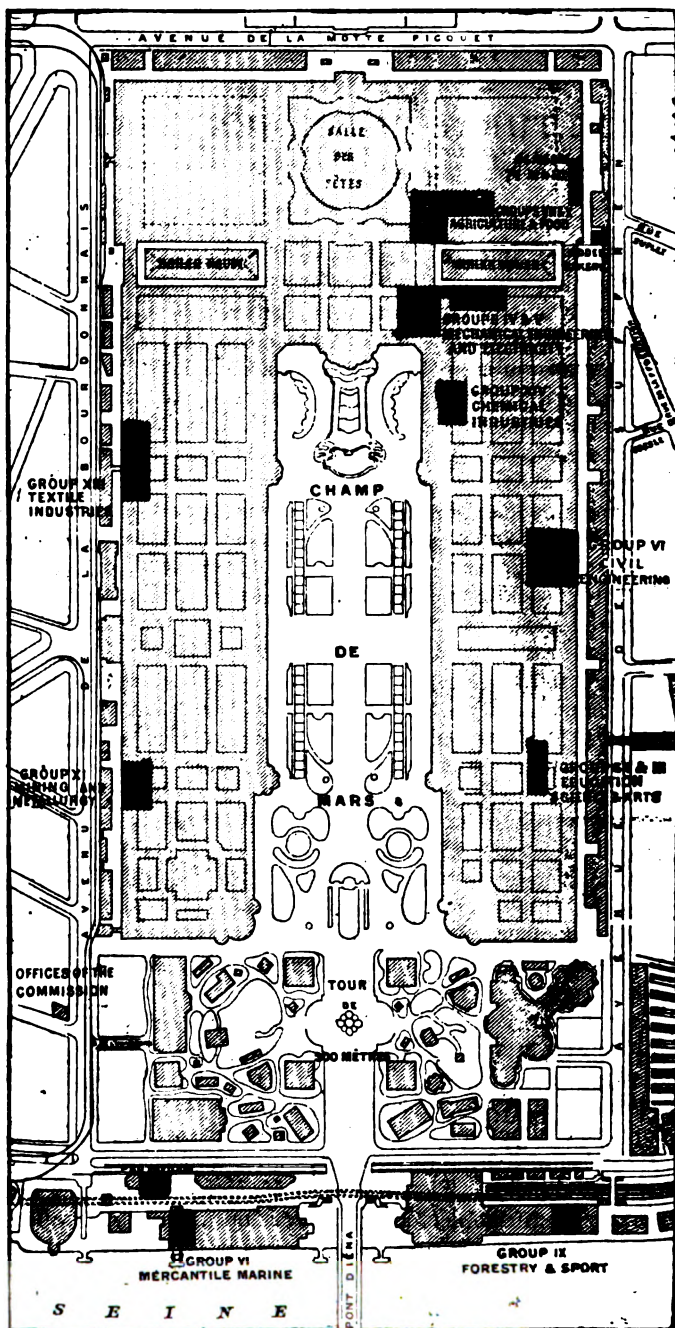
Wilburton, Isle of Ely.

## AGRICULTURAL IMPLEMENTS AT THE PARIS INTERNATIONAL EXHIBITION, 1900.

BEFORE commencing a description of the exhibits in Group VII., Class 35, which was confined solely to agricultural machinery, and to which my observation was particularly directed, some few general notes on the Paris International Exhibition as a whole would no doubt be of interest. Not only were the buildings situated on both banks of the Seine, but the spaces available consisted of two rectangular areas on the south side with two irregular areas on the north side immediately opposite, connected by bridges, together with a strip of ground on either side of the river, that on the south side being occupied by the representative pavilions of foreign countries, and the naval and military exhibits, whilst that on the north bank was occupied by a representation of "Old Paris," and by sections devoted to horticulture and arboriculture.

In the disposition of the grounds there were two main avenues, the first entered from the Champs Elysées, with two magnificent buildings on either side, called respectively the "Grand Palais" and the "Petit Palais." The former contained international modern paintings, sculptures, and other works of art, and the latter was used exclusively for ancient French works of art. Both structures are happily permanent, and destined to survive the Exhibition. A handsome new bridge, the "Pont Alexandre III.," leads to the buildings on the south side of the river arranged on either side of the Esplanade des Invalides, in which were exhibited the various branches of art-decoration, furniture, &c.

The second main avenue extended from the Palais du Trocadéro, crossing the Seine by the Pont d'Jéna, and extending under the Eiffel Tower through the centre of the Champ de Mars to the Salle des Fêtes. On either side of this avenue were the main Exhibition galleries: on the east metal-lurgy, mines and cloth fabrics, on the west civil engineering, transport and education, while the main cross gallery on the north was occupied by the Salle des Fêtes, and agricultural and electrical machinery. The two main blocks on the south side of the river were connected by means of an electric railway running in one direction and a revolving platform moving in the other. The space on the north side of the river near the Trocadéro was occupied by the colonial exhibits of all nations.



The buildings and their general arrangement were all that could be desired, and to give some idea of their magnitude I may say that the area above described covered 275 acres, of which 113 were roofed over, in addition to which there was an area of about 87 acres at Vincennes devoted to railway plant and sundry colonial exhibits. In 1889 the total area roofed over was 71·63 acres.

The position allotted to agricultural machinery in Group VII., Class 35, could hardly have been a better one; and in this respect the section possessed a decided advantage over previous International Exhibitions held in Paris. In 1878, the British Agricultural Machinery Section was in an Annexe on the Champ de Mars, and a very good display was then made; but in 1889 the British manufacturers to a large extent refrained from exhibiting, owing to difficulties of space and to the position of the class, which was located in buildings along the left bank of the Seine. This year agricultural machinery was placed in the large pavilion, known as the "Palais des Machines" on the Champ de Mars, and the spot selected was one of the most prominent in the Exhibition. The plan on page 654 of the Exhibition buildings on the Champ de Mars will serve to show the position allotted to Group VII. (agriculture) and Group X. (food products), together with the proportion of space occupied by British exhibitors. This plan is reproduced from the British Official Catalogue by the courtesy of the Royal Commission.

In the centre of this Pavilion, which had been standing since the previous Exhibition of 1889, when it was used for the display of heavy engines, machine tools, etc., had been erected one of the principal buildings of the recent Exhibition, viz. the "Salle des Fêtes," an ornate and imposing structure with a floor space larger than the entire area of the Albert Hall in London, and capable of accommodating from 14,000 to 15,000 persons. Immediately around this building was the area devoted to agricultural machinery, and it constituted a very large and important display.

Naturally, the French exhibit occupied most of the space; but if other countries were somewhat cramped, it was with a certain feeling of relief that one missed the ever present duplicates at similar exhibitions, whilst it was yet possible, in the limited space, to see some of the best productions of the manufacturers of the various countries represented. In some cases the restricted space available may have borne hardly on exhibitors, in that they could not place before the public an adequate representation of the variety of their manufactures; but whilst admitting this, I must also say—making every

allowance for limited space—that the selection and arrangement of the exhibits made by some of the English manufacturers was scarcely such as to do them justice.

It was pleasing to me, however, as one of the Jurors of this Section, to find that the English exhibits, though not so numerous as one might have wished, were of the very highest class; and it was the general opinion that the British section still maintained its foremost position amongst the countries exhibiting, both as regards the design and workmanship of the several engines and machines exhibited. Although this position was maintained by Great Britain, I could not but notice in contrasting the present with previous International Exhibitions the very marked progress and improvement in the quality of the exhibits of other nations. The exhibits of French machinery were exceptionally good, though, owing doubtless to the special requirements of French agriculturists, their design is different from that usually adopted in this country. The show of French ploughs, for instance, formed a most important exhibit. There was also a very large exhibit of portable engines, threshing machines, grist mills and cider and wine presses.

In describing the various agricultural implements that were on view, I propose for the sake of convenience to take first those of the English-speaking communities, Great Britain, Canada, and the United States, and then those of France and the other European countries.

## GREAT BRITAIN.

### AGRICULTURAL ENGINES.

Agricultural engines were exhibited by such well-known firms as Messrs Clayton & Shuttleworth, of Lincoln; Messrs. John Fowler & Co., Ltd., of Leeds; Messrs. R. Garrett & Sons, Ltd., of Leiston, Suffolk; Messrs. Marshall, Sons & Co., Ltd., of Gainsborough; Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich; and Messrs. Ruston & Proctor, Ltd., of Lincoln.

Messrs. Clayton & Shuttleworth exhibited a portable steam road roller and traction engine combined, which is provided with two travelling speeds, compensating gear, winding drum and wire rope. It is a very serviceable machine, and the arrangements for removing the front roller and replacing it by its fore carriage are very simple. There was also a well-finished portable steam engine, with adjustable expansion gear, the fire-box being specially large for burning either coal or wood. In conjunction with this engine was exhibited one of the firm's standard threshing machines.

Messrs. Fowler & Co. exhibited a single-cylinder steam ploughing engine, fitted with two steel winding drums for working on the single engine system, and a single-furrow vine plough for working with the engine; also a compound road locomotive fitted with patent spring gear. Messrs. Garrett & Sons showed a portable steam engine and threshing machine, with a straw chopping and bruising apparatus to be used in conjunction with the threshing machine. They also showed one of their clover hullers, similar to those exhibited at the Royal Agricultural Society's Shows, as well as examples of their patent reversible threshing machine beaters, and their corrugated fire-boxes for portable or traction engines.

Messrs. Marshall & Co. certainly made the best of the space at their disposal, and had a most excellent exhibit of no fewer than six engines of varying sizes, from a five-horse power portable engine to a 10-ton agricultural combined road roller, besides one of their standard threshing machines.

The exhibit of Messrs. Ransomes, Sims, & Jefferies consisted of an eight horse-power single cylinder portable steam engine, fitted with Head and Schemioth's patent apparatus for burning straw; a double-blast threshing machine, with rotary corn screens and accessories; three horse ploughs, and one of their 13-tined cultivators.

A portable engine and large-sized threshing machine, together with a single cylinder traction engine, constituted the exhibit of Messrs. Ruston & Proctor.

#### HARVESTING MACHINERY.

Amongst those who exhibited reaping and mowing machines may be mentioned Messrs. Harrison, McGregor, & Co. Ltd., of Leigh, Lancashire; Messrs. R. Hornsby & Sons, Ltd., of Grantham; and Messrs. Samuelson & Co., Ltd., of Banbury. Messrs. Massey, Harris, & Co. also exhibited; but as their main exhibit was in the Canadian section at Vincennes, they are described with the exhibits of that section (see p. 660).

Of the English-made machines Messrs. Harrison, McGregor presented the largest and most important exhibit. Their machines, both in design and workmanship, were of first-rate quality, and one had the advantage of seeing them shown in the state in which they are actually sold and used on the farm, i.e. without superfluous decoration and plating. The exhibit consisted of mowers, self-rake side delivery reapers and binders, together with some corn-grinding mills and a chaff-cutter. Special attention may be called to their low elevator binder, which has several modifications in points of detail,

resulting in the production of a very workmanlike looking machine. Its balance has been carefully adjusted; the driver's seat has been placed at a low level behind the machine, so that the working parts are well in front of him; and all the controlling levers are arranged conveniently to his hand. Fortunately this excellent collection occupied a prominent position in the building.

The exhibit in the Agricultural Section of Messrs. Hornsby and Sons was somewhat meagre. It consisted of a Hornsby patent sheaf-binding harvester of the pattern tried at the Chester Meeting of 1893, when it received the Society's First Prize in open competition; one Hornsby mower, and two straw trussers for use in conjunction with a threshing machine: all of excellent workmanship and design, but hardly representative of the variety of machines manufactured at the well-known Grantham works.

It is a matter for regret that this firm did not, even in the limited space available, make a better show in this class. Their oil engines, one of which was exhibited in another class, appear to be appreciated in France, several of the French self-contained engines and threshers, hereinafter described, being worked by a five horse-power Hornsby-Akroyd oil engine.

Messrs. Samuelson & Co. showed one- and two-horse mowing machines, with the necessary attachments for reaping, also self-raking side delivery reapers, and self-binding harvesters.

#### CHAFF-CUTTERS, MILLS, SLICERS, &c.

These were represented by such firms as Messrs. Bamford & Sons of Uttoxeter; Messrs. E. H. Bentall & Co., of Heybridge, Essex; Messrs. John Crowley & Co., of Sheffield; Messrs. W. N. Nicholson & Sons, Ltd., of Newark-on-Trent; and Messrs. Richmond & Chandler, Ltd., of Manchester. In this department the superiority of the English exhibits over those of other countries was very marked.

Messrs. Bamford & Sons had a very useful exhibit of chaff-cutters and grist mills, the latter with their reversible steel grinding plates, together with their mowing machines. Messrs. Bentall & Co. exhibited turnip slicers, pulpers, chaff-cutters, and grist mills, driven by hand or mechanical power.

Messrs. Crowley & Co.'s exhibit consisted solely of five chaff-cutters of various sizes, all of excellent design, with hinged cover for the cutting wheels, and with safety feed-guards. They also had adjustments for cutting two different lengths of straw. These machines have not only competed successfully in

competitive trials in Paris, but several of the larger machines are in use there.

Messrs. Nicholson & Sons showed their horse rakes and corn mills, which compared very favourably with other machines of the kind. Messrs. Richmond & Chandler's display of chaff-cutters, corn-crushers and mowing machines was quite up to their excellent standard.

#### OTHER EXHIBITS.

In horse-ploughs Great Britain made a very poor show, mainly owing to want of space. The principal exhibitors were Messrs John Fowler & Co., Ltd., of Leeds; Messrs. James & Frederick Howard, of Bedford; and Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich.

Messrs. Fowler & Co. exhibited one large set of steam ploughing tackle. The Messrs. Howard and Messrs. Ransomes showed a couple of ploughs each; but Messrs. Howards' main exhibit was a hay and straw press for pressing and tying in bundles direct from the threshing machine or rick, the apparatus being similar to that shown at the York Meeting of this year, in which dividing boards were dispensed with and automatic threading was adopted. The other exhibits of this firm included some light contractors' railway plant and a couple of harrows, the whole collection in no way doing justice to the firm's general output at home.

In view of the totally inadequate representation of British ploughs at the Exhibition, whether as regards the different varieties or the numbers of these implements produced by British manufacturers, I purposely refrain from attempting any special notice of those sent, since to do so would serve no useful purpose, and might very possibly mislead.

For corn and seed drills, a distinct preference was shown by the Continental Jurors for the spoon system of distribution, which was represented by Messrs. James Smyth & Sons, Ltd., of Peasenhall, Suffolk.

#### CANADA.

The Canadian Implement Manufacturers were, owing to lack of space on the Champ de Mars, obliged to erect a special building in the Annexe to the Exhibition at Vincennes, which is an outlying suburb about  $5\frac{1}{2}$  miles from the centre of Paris. The Canadian agricultural machinery was not, therefore, so accessible as could have been desired; nevertheless the excellence of the exhibit well repaid a visit. In fact, it is

perhaps hardly too much to say that no exhibit showed so striking an advance during the past ten or fifteen years as that of Canada, and could it have been located within the Exhibition proper it would have held its own with that of any other country. The machinery is thoroughly up to date, and of the very highest finish. The display was larger and more completely representative than any made by Canada at previous Paris Exhibitions, and the progressive spirit of the Canadian manufacturers is worthy of every praise. Harvesting machinery, ploughs, spring-tine cultivators, seed drills, haymakers, etc., were exhibited in as nearly a state of perfection as possible by such firms as The Cockshutt Plow Co. of Brantford, Ontario; Messrs. Massey Harris & Co., Ltd., of Toronto; Messrs. David Maxwell & Sons, of St. Mary's, Ontario; The Noxon Co., Ltd., of Ingersoll, Ontario; and The Verity Plow Co., Ltd., of Brantford, Ontario.

The Cockshutt Plow Co. had one of the very best exhibits of ploughs in the Exhibition, their design coinciding more with our own modern practice than that of any other nation. Messrs. Massey Harris & Co. exhibited their well-known mowers, reapers and binders with all latest improvements, hayrakes and spring-tine cultivators, this exhibit with that in the main building forming one of the best displays of harvesting machinery. Messrs. David Maxwell & Sons exhibited a mowing machine, a binding harvester, a side-delivery reaper, a hay rake and tedder, and two scufflers. The Noxon Co. had a large general exhibit, consisting of mowing and reaping machines, seed drills, cultivators, spring-tine and chain harrows, disc harrows and petroleum engine, all of excellent design and workmanship. The Verity Plow Co. exhibited some well-designed and highly finished ploughs for different purposes, and a couple of expanding scufflers.

Other exhibits in this section, though not so large, also bore evidence of the progress made by Canadian manufacturers.

#### AWARDS TO BRITISH EXHIBITORS.

In the Official Catalogue and award lists, Canadian manufactures are grouped with those of the United Kingdom. In giving the awards for agricultural machinery, I follow the same plan by including the Canadian manufacturers under the general heading of "British Exhibitors"; but for greater convenience I have distinguished between the Canadian awards and those of the United Kingdom by placing them in separate paragraphs.

The regulations provided that the awards should take the form of diplomas, signed by the Minister of Commerce and the Commissaire-Général of the Exhibition. They consist of Grand Prix, Gold Medal, Silver Medal, Bronze Medal, and Honourable

Mention Diplomas. In Group VII., Class 35, five Grand Prix Diplomas were awarded to exhibitors from the United Kingdom : viz. to Messrs. Clayton & Shuttleworth, of Lincoln ; Messrs. John Fowler & Co., Ltd., of Leeds ; Messrs. Marshall, Sons & Co., Ltd., of Gainsborough ; Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich ; and Messrs. Ruston, Proctor & Co., Ltd., of Lincoln. The Gold Medal Diploma was awarded to fourteen exhibitors, viz. to Messrs. Bamford & Sons, of Uttoxeter ; Messrs. E. H. Bentall & Co., of Heybridge ; Messrs. Robert Boby, Ltd., of Bury St. Edmunds ; Messrs. John Crowley & Co., Ltd., of Sheffield ; Messrs. Richard Garrett & Sons, Ltd., of Leiston ; Messrs. Harrison, McGregor & Co., Ltd., of Leigh ; Messrs. R. Hornsby & Sons, Ltd., of Grantham ; Messrs. James & Frederick Howard, of Bedford ; Messrs. Musgrave & Co., Ltd., of Belfast ; Messrs. W. N. Nicholson & Sons, Ltd., of Newark-on-Trent ; Messrs. Penney & Co., Ltd., of Lincoln ; Messrs. Richmond & Chandler, Ltd., of Manchester ; Messrs. Samuelson & Co., Ltd., of Banbury ; and Messrs. James Smyth & Sons, Ltd., of Peasenhall. Five Silver Medal Diplomas were awarded : viz. to Mr. A. C. Bamlett, of Thirsk ; Messrs. Barford & Perkins, of Peterborough ; Messrs. Blackstone & Co., Ltd., of Stamford ; Messrs. Philip Pierce & Co., of Wexford ; and Messrs. Sargeant & Co., Ltd., of Northampton.

Canada secured one Grand Prix, five Gold Medal and six Silver Medal Diplomas. The Grand Prix was gained by Messrs. Massey, Harris & Co., Ltd., of Toronto. The Gold Medal Diplomas were won by the following Ontario firms : The Cockshutt Plow Co., Ltd., of Brantford ; The J. W. Mann Manufacturing Co., Ltd., of Brockville ; Messrs. David Maxwell & Sons, of St. Mary's ; The Noxon Co., Ltd., of Ingersoll ; and The Verity Plow Co., Ltd., of Brantford. The Silver Medal was awarded to The Coulthard Scott Co., of Oshawa, Ltd. ; J. Fleury's Sons, of Aurora ; Mr. William A. Gerolomy, of Tara ; The Ontario Wind Engine and Pump Co., of Brantford ; The Peter Hamilton Manufacturing Co., of Peterborough ; and Messrs. S. Vessot et Cie., of Joliette, Quebec—all except the last named belonging to the Province of Ontario.

### THE UNITED STATES.

The United States Implement Department was located in an Annexe at the end of the Agricultural Machinery Court. The scope of the exhibit was disappointing, in that it was one exclusively of mowing and reaping machines, horse rakes and ploughs, no engines or threshing machines, and very few miscellaneous implements being shown. The mowing and

reaping machines formed in themselves a most comprehensive exhibit, and the following firms were represented :—

ADRIANCE, PLATT & Co., Poughkeepsie, New York.  
 AULTMAN, MILLER & Co., Akron, Ohio.  
 DEERING HARVESTER Co., Chicago.  
 JOHNSTON HARVESTER Co., Batavia, New York.  
 McCORMICK HARVESTING MACHINE Co., Chicago.  
 MILWAUKEE HARVESTER Co., Milwaukee, Wisconsin.  
 OSBORNE, D. M. & Co., Auburn, New York.  
 PLANO MANUFACTURING Co., Chicago.  
 WARDER, BUSHNELL & GLESSNER Co., Chicago.  
 WALTER A. WOOD MOWING AND REAPING MACHINE Co., Hoosick Falls, New York.

Some of the machines exhibited by these firms were prepared in truly "Exhibition style," the lavish use of fancy polished woods and ornamental plating demanding a considerable exercise of the imagination as to what the real workaday machine would look like. I do not suggest that in design and mechanical workmanship the machines sold in the market differed from those exhibited; but surely the presentation to the eye of the machine itself as actually used is of far more interest than of one which can only be looked upon as an Exhibition model.

In the whole exhibition of harvesting machinery there was little of real novelty, the machines being identical in general design with that with which the public have now for some years been familiar. That the design of these machines should have become almost stereotyped is not to be wondered at when one is credibly informed that the daily output of some of the larger makers reaches the enormous figure of from 1,200 to 1,300, which, however, includes rakes and seed drills. In this connection I am also informed that a remarkable development has taken place in recent years in the manufacture of maize or Indian-corn harvesters. Maize being the principal cereal of the United States, the production of harvesters capable of expeditiously reaping this somewhat unwieldy crop assumes considerable importance. Last year, in 1899, the total acreage under maize in the United States was not less than 82,108,587. As the combined total acreage of the wheat, barley, oats, rye, and buckwheat crops in the same year was not more than 76,141,581, the excess of last year's maize acreage over that of all other cereals in the United States was 5,967,006. Moreover, there was an increase in the maize acreage of 1899 of 4,386,806 over that of the previous year, 1898. As showing how the use of maize harvesting machinery has developed during recent years, I was informed by one exhibitor that

whereas in 1895 they only sold three maize huskers and shellers, in 1899 they sold as many as 4,000. Of ordinary maize harvesters, the same firm state they sold 20,000 in 1899 as against one in 1889. Maize not being a British cereal, the manufacture of maize machinery has no direct interest for this country. At the same time it may be pointed out that the increased importation of this cereal into Great Britain during recent years corresponds with the increased acreage of the crop in the United States.

At the Paris Exhibition of 1889, an exhibit by the Walter A. Wood Co. of a harvester binding with straw attracted considerable attention, and seemed full of promise. Nothing appears to have come of it, however; and it was a little disappointing in the present year to notice that no further attempts have been made in the same direction.

The two largest and most attractive exhibits were those of the McCormick Harvester Co. and the Deering Harvester Co. The former not only had a very extensive and elaborate exhibit in the United States Annexe, but a still larger one in a building which they constructed specially at Vincennes. Here the several machines could be seen in motion. Amongst them were some interesting specimens of Messrs. McCormick's earliest machines, and for the enlightenment of those desirous of following the growth and development of the Company an exhibition of lantern slides was arranged illustrating the several stages of the McCormick harvester and its application in various parts of the world.

One novelty in the exhibit at Vincennes was a harvester worked by an oil motor. At the time of my inspection it had only just arrived from America, and it could scarcely be considered in working order. The possible demand for a harvesting machine capable of being worked by mechanical power was recognised by the late Mr. Thomas Aveling, who at the Royal Agricultural Society's Birmingham Meeting of 1876 exhibited a reaping machine, suspended as it were from the jib end of a traction crane. In that form the machine was only of service where a traction engine was already available. For the ordinary farmer, who had no use for a traction engine, it was perfectly impracticable, as the cost of the engine would have been a prohibitive item.

The conditions which led Mr. Aveling in 1876 to turn his attention to a mechanically driven harvester are now in this country very much accentuated. The difficulty occasioned by the scarcity of agricultural labour is more acute, and consequently a machine capable of efficiently dealing with the harvest

and at the same time of reducing the amount of manual labour should meet with a ready demand. It is only requisite that the motor and its combination with the harvester should be of such simple form that they should not require any more technical skill than that possessed by an operator of the present binder. The early binders were considered by many as much too complicated to be of practical use to the farmer; but by the simplification of the machine and a little levelling up of the agriculturist—easily accomplished when he realised the advantages to be obtained—the difficulty soon disappeared. The time is probably not very far distant when we shall similarly see motor binders largely used.

Although in this country we have not the immense corn-growing districts of other countries, we may claim, without exciting envy, perhaps the most fickle climate in which to gather our harvest. The economy, therefore, of an efficient machine which could remain at work during the whole of a summer's day without the necessity of fresh relays of horses is very apparent, whilst the horses thus set free would be at liberty to carry the earlier cut crops as they became ready for the stack or the threshing machine. I fully expect to see such a machine as I have indicated in the near future, although I scarcely consider that the American self-moving harvester at the Paris Exhibition is as yet sufficiently developed for practical purposes.

The other McCormick machines exhibited need not be described in detail here, as their design is well-known to readers of the Journal. There is, however, one apparently small detail which was interesting, and that is a novel form of pitch chain. Instead of the links in this chain being made of malleable cast iron, they are now stamped out of a flat ribbon of steel, the portions of which are bent into the desired shape. The new chain is exceedingly light in weight, and should be stronger and more uniform than the malleable cast chain. Some interesting models were exhibited, showing the several stages of the McCormick harvester from its invention to the present time.

The Deering Co. exhibited mowing machines, reapers, binders, a motor binder and a horse-rake, all of excellent design and finish. One special feature of these machines is the almost universal application of roller bearings to the several parts and of ball bearings at the ends of shafts where there is any tendency to lateral thrust. Their use no doubt very materially reduces the friction in the working parts; but of course they require attention, and in consequence they have not been so

universally adopted by other makers. The motor binder, as far as I could ascertain, had as yet received no general application, and the remarks made with regard to the McCormick motor harvester apply equally here. The Deering Co. had also an important exhibit of manilla binding string, of which they are large manufacturers. Indeed, they claim to be not only the originators of this particular string, but also to manufacture one-third of the entire output of the twine used for binding purposes.

In the Agricultural Section, in the main building, was a most interesting exhibit of some hundred models and illustrations made for the Exhibition by the Deering Co. at the request of the United States Commissioner. The models were ingeniously arranged so that they could be set in motion by the visitor. They were illustrative of the various developments by different inventors of the reaping machine, and commenced with the original implement of the Gauls, consisting of a low cart, or box on wheels, armed with prongs which engaged the ears of corn. The cart was pushed by an ox into the crop; the ears of corn, caught by the prongs, were decapitated with a sickle by hand and were delivered into the cart. In 1806 the Gladstone reaper was produced, the model of which at once illustrates many of the salient points of the present machines, though the real prototype of the present machines may fairly be stated to have originated in the machine invented by the Revd. Patrick Bell of Scotland in 1827. The remaining models illustrated the several stages through which reaping machinery has passed, including mowers and reapers, side-delivery reapers, wire binders, string binders, and the later developments of the maize harvester and binder.

The Adriance Company exhibited the latest example of their low delivery reaper. This machine was first shown in England at this Society's Meeting at Doncaster in 1891, when it was tried under exceptionally severe conditions in a green crop, and received the Society's Silver Medal. Those who witnessed the trial were much impressed with the accuracy with which it worked, and with the great advantage gained by dispensing with elevator aprons, and with the necessity of raising all the corn on to a high binding platform, thus materially reducing the working parts and draught of the machine. Notwithstanding these advantages, however, this reaper does not seem to have made its way in this country.

The Osborne Co., who have been associated with some of the early developments of harvesters, had an excellent exhibit of mowers, and a side-delivery reaper and binder, together with hay-tedder, horse-rake, spring harrow, disc harrow and cultivators.

These formed one of the most comprehensive exhibits in the section, and were all of high merit. The Milwaukee Harvester Co. and the Johnstone Harvester Co. each made a good exhibit of their respective manufactures, and the Walter A. Wood Co. also exhibited their well-known machines. The Plano Manufacturing Co. showed a reaper, which has been exhibited in this country, and in which the binder is actuated by a lever action instead of through gearing. It is claimed to be a "wonderful improvement over cumbersome cog-wheels," though it has not yet overtaken machines of this type.

The principal plough exhibits were those made by the Syracuse Chilled Plow Co. and Messrs. Deere & Co., both of whom showed disc ploughs for which special advantages are claimed. The discs are placed on a horizontal axis, very much after the fashion of a ring roller, except that the discs are rigidly keyed on to the shaft at some distance apart from each other. The shaft is hinged at its centre, and, with the shaft in a straight line, the discs pass lightly over the ground as a disc harrow; but by advancing the outer ends of the shaft, thus placing the discs at an angle to the direction of the travel, they enter more deeply into the ground, and the desired depth of cultivation can thus be obtained. There was also an exhibit of Oliver steel ploughs, as frequently seen at the Society's shows.

### FRANCE.

France, like other countries, has shared in the universal progress which agriculture has made during the present century, but it is only during the last twenty years that the manufacture of agricultural implements has become successfully established as a French industry. The following Table, extracted from the French official catalogue, shows the number of agricultural implements annually imported into, and exported from, France for the years 1889-98 :—

TABLE I.—*French Imports and Exports of Agricultural Implements.*

Year	No. of Implements Imported	No. of Implements Exported
1889	2,679,299	2,054,366
1890	3,004,431	3,465,106
1891	4,330,328	3,393,228
1892	4,774,295	3,062,466
1893	4,446,963	2,699,142
1894	3,598,113	3,115,568
1895	5,411,263	3,066,435
1896	5,693,210	2,988,029
1897	8,093,921	3,248,170
1898	12,618,150	4,004,595

It will be seen from this Table that there has been a large increase in the number of agricultural implements imported into France during the last two years for which figures are available, and that since 1894 the number of such imports has more than doubled. On the other hand the number of exports from France has remained almost stationary, with the exception of a notable increase during the year 1898.

The following Table, taken from the French census of 1896, will give some idea of the extent of French agricultural implement works and other factories connected with French rural industries:—

TABLE II.—*Number of Workmen employed in French Rural Factories according to 1896 Census.*

Industry	Total No. of workmen employed	Total No. of establishments employing more than five workmen	Division of these establishments according to the number of workmen employed		Departments employing most workmen, with the percentage of the whole employed by each
			under 50	50 to 100	
Agricultural Implements	7,500	247	229	18	—
Grading and Milling Machinery	900	19	16	3	Seine - et - Oise, 54; Bouches - du - Rhône, 18
Drainage and Irrigation Works	500	13	13	—	Seine - et - Marne, 16; Nord, 10; Calvados, 9
Manure Factories	3,300	108	95	13	Seine, 21; Charente - Inférieure, 16; Nord, 9

Owing to the large amount of space placed at their disposal by the Exhibition authorities, French manufacturers of agricultural implements were able to make a better display than any other country. It is therefore impossible to give in this article a detailed description of all the various exhibits; nor, indeed, is such necessary, because by far the larger proportion of the machines exhibited, though no doubt meeting the demands of the French agriculturist, would not be of service in this country.

#### PLOUGHS.

Ploughs of various forms constituted perhaps the most important French exhibit, and those shown by M. Antoine Bajac, of Liancourt, Oise (hors concours), may be taken as typical examples. Amongst them were several heavy steam ploughs, some for deep cultivation with single breast, others with breasts

for six or eight furrows. It would appear, however, that the employment of these large steam ploughing tackles is limited to the deep cultivation necessary for vineyards and for the sugar-beet districts. Otherwise there is the same decreased demand for them in France that we have already experienced in England.

In the horse-ploughs the general French design for raising or lowering the front wheels is a screw head adjustment, which certainly seems a more cumbrous arrangement than the crank axle and lever generally adopted by English and American plough makers. There appears to be a great demand for what

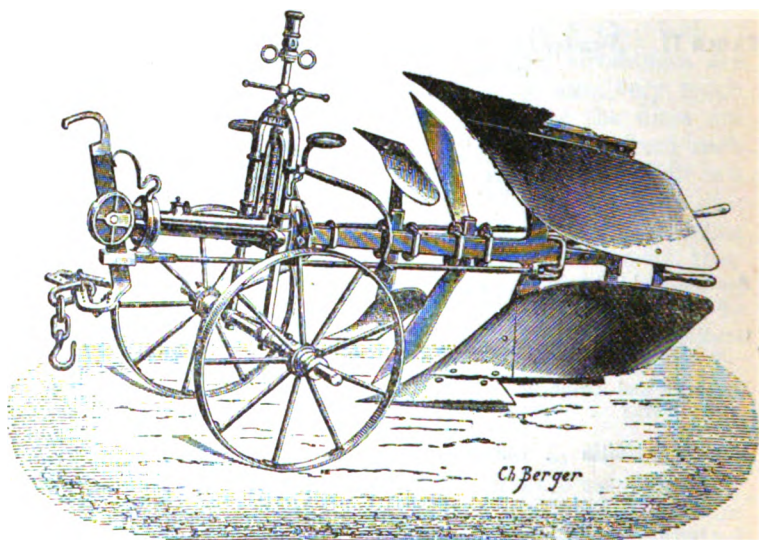


FIG. 1.—Brabant Double-breasted Plough.

is termed the "Brabant" plough, with one or more breasts, and this type of implement was to be seen on the stall of nearly every exhibitor (fig. 1).

The following remarks, which are taken from the French official catalogue of Class 35, are reproduced as of interest to English readers, although I do not necessarily identify myself with all that is there stated :—

At the commencement of this century we ordered our machines from England. The manufacture of this class of implements was of Scottish origin, and it soon extended to the whole of the United Kingdom. But from 1849 the manufacture of tillage implements commenced in France. It increased greatly in 1855, but unfortunately we could not manufacture cheaply enough; it was only in 1878 that equality was established between us and Great Britain. The first studies of the plough were made by a

Scotchman, named Small (1763), whose ideas were later applied by Wilkie and Finlayson. But it is especially to Grangé, a simple farm labourer, and to Mathieu de Dombaale that the essential improvements in the plough are due; those who came afterwards only continued their work. The plough used everywhere to-day is the Brabant. It came to us from Belgium. Its use rapidly became general, thanks to our manufacturers of the North, who have given it its latest improvements, and who have made of its manufacture an essentially French industry. It is estimated that the number of Brabant ploughs used in France is 4,500,000.

### THRESHING MACHINES AND ENGINES.

Some few makers, such as Théophile Gautreau of Dourdan, Seine-et-Oise (hors concours), who also was one of the earliest French agricultural engineers, exhibited threshing machines of the size ordinarily met with in the English market, and these followed closely the designs of British manufacturers of a few years ago. They can scarcely be considered as equal to the present British type. In addition, however, there was a very considerable exhibit of threshing machines and engines for which certainly there is no demand in this country. Their use points to the fact that the material with which these machines have to deal must be very much shorter in the straw than the crops met with in this country.

Another novel feature of French threshing machines was the combination of a thresher with an oil engine to work it (fig. 2).

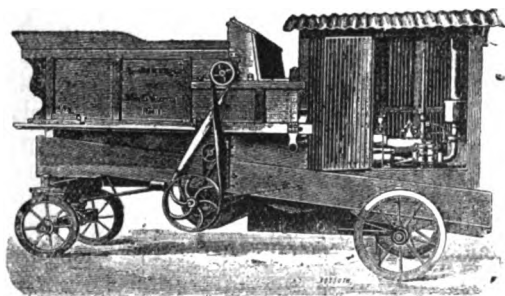


FIG. 2.—Self-contained Oil Engine and Threshing Machine.

In this combination, the oil engine was something between a nominal four and five horse-power, and this at once marks the difference between the class of machine in general use in this country and that which commands a market in France. As shown by the trials at Doncaster in 1891, the ordinary threshing machines in England require an actual brake horse-power of something like 15 B.H.P. An oil engine of 4 or 5 B.H.P. works very little over its nominal power, consequently the

capacity of these French machines as compared with our ordinary threshing machine would be approximately represented by the power of the engine.

One was glad to notice that so far as the engine was concerned the "Hornsby-Akroyd" seemed to have met with a favourable reception in France, as it was employed on several of the machines exhibited. I confess that the combination of such an engine with the threshing machine surprised me, as, to my mind, if a self-contained engine and threshing machine is thought to be desirable, it would be wiser to make the combined machinery independent of extraneous assistance for its locomotion. There is indeed no reason why the engine in a machine of this description should not be self-propelling, as well as, when stationary, provide the necessary power for threshing. Our agricultural locomotive engines are now being used to serve the double purpose of driving the threshing machine and straw elevator, as well as of moving the whole apparatus from farm to farm.

In the portable engines exhibited there is not the same uniformity of practice that there is in England. Taking the general type of portable engine used in this country we have a practically stereotyped form of fire-box and boiler—i.e. the rectangular fire-box at one end of a tubular boiler, the tubes leading direct to the smoke-box at the other end. The French portable engine, on the other hand, has no stereotyped design, some makers adopting the rectangular stayed firebox common in this country, others preferring a cylindrical form, which although it gets rid of the stays, makes a more difficult connection with the barrel of the boiler and the tube plate; at any rate, the latter appears to be the favourite type with French manufacturers, especially in the smaller sizes. There is also an apparent difference of opinion as to the position in which the fire-box should be placed, as the placing of the furnace at the smoke-box end and the use of return tubes, though exceptional in this country, is by no means so in France.

#### CHAFF CUTTERS.

Owing possibly to the absence in France of any measure resembling the Chaff Cutting Machines (Accidents) Act of 1897, the ingenuity of French makers of chaff cutters has not been stimulated to the same degree as in the case of the English makers of these machines; for there was certainly a lack of safeguarding appliances. One was also surprised to find that the spiral horizontal cutting knife, similar to that used in slate

quarries for trimming slates, is very generally adopted in France, whereas the universal custom in England is to have convex knives mounted in the fly-wheel of the machine. There was nothing in these machines to call for any special notice.

#### OTHER EXHIBITS.

Amongst the miscellaneous implements one expected of course to find wine and cider presses in considerable numbers. For such machines we in England have but little demand; but it is evident that great care and thought, with varying success, have been given to their development and to the most efficient system of leverage for obtaining the necessary amount of pressure in the machines. There were consequently many interesting adaptations of pawl and ratchet movements.

Side by side with the agricultural machines now used in France was a "Section Retrospective Agricole," organised by the French Ministry of Agriculture, with the assistance of contributions from the National Veterinary Schools of Alfort, Lyons, and Toulouse, and of numerous loans by private collectors. To antiquarians in general, as well as to those desirous of studying the gradual evolution of French agricultural implements and processes, this was one of the most interesting and instructive features of the agricultural department. The exhibits were displayed in five excellent reproductions of ancient French rural buildings, two of them being used respectively for the reconstitution of an ancient French distillery and a common hall and kitchen, and the remaining three for the illustration of other features of past rural life, and for a large display of ancient agricultural tools and implements. The collection was complete and comprehensive, and it is impossible to describe all the miscellaneous articles thus brought together, representative as they were of many departments of rural industry of different epochs. There were, however, excellent life-sized models of ancient rural officials, such as the "Garde Champêtre" or rural constable; an equestrian model of the "Gardien de Taureaux" or Bull Guardian; a model on stilts of a "Landes" Shepherd, whose pastoral duties appear to have been combined with the knitting of woollen stockings. A good collection of ancient horse-shoes and veterinary instruments came from the Ecole Nationale Vétérinaire at Lyons, the horse-shoes dating from Roman times, and the instruments including an Arabian paring knife and a docking machine of the tenth century. There was also the model of an ancient shoeing forge, with specimens of the old hand-lever chaff cutter,

and a curious threshing machine, dated 1785, the mechanism of which consists of wooden flails actuated by wooden spokes on a spindle turned by hand, the force of the beaters being obtained by steel springs. Other exhibits comprised an antique chair salt-box, the salt-box being underneath the seat; pedal silk-worm threaders used by small proprietors fifty years ago, but now superseded by power looms; wooden Picardy ploughs of 1836 and 1850, and other wooden ploughs of earlier date, wheelbarrow seed drills, an iron hand-mill of 1626, a wooden wheat-mill, an ancient churn, a flax-brake, cider presses, ancient wine bottles and beehives, and a number of rural proclamations of the last century.

### OTHER EUROPEAN COUNTRIES.

Germany and Hungary showed each the progress they have made by some excellent threshing machinery and steam-engines. Herr Heinrich Lanz of Mannheim (*hors concours*) exhibited an excellent example of a portable engine and threshing machine built after a good English model. The "Direction de la Fabrique de Machines des Chemins de Fer de l'Etat et des Aciéries de Diosgyör" of Budapest made a similar exhibit, but with a steel-framed thresher, and also showed some excellently finished mowers and reaping machines. Messrs. Garrett, Smith & Co., of Magdeburg, also made a very good display.

Ploughs and other implements were shown by such makers as Herr H. F. Eckert, of Berlin, Herr Rud. Sack, of Leipzig-Plagwitz, and Herr E. Kühne of Moson and Budapest. One very interesting feature of the Austrian and Hungarian displays were the Statistical and Educational Exhibits, where the most detailed information as to rainfall, drainage, crops, etc., was recorded. Several interesting models of the different Hungarian breeds of live stock were shown, and a most complete collection of foods, etc.

Switzerland made a striking show. The machines of M. Frantz Ott, of Worb, Berne, and of M. J. Stalder, of Oberburg, Berne, were of high class, whilst M. Daverio's milling machinery (*hors concours*), although not coming precisely in Class 35, may be cited as of supreme excellence. In the Swiss section were also examples of refrigerating machinery, some of small size suitable for the requirements of butter factories, etc., and a comprehensive collection of prepared foods, amongst which the milk preparations of M. Henri Nestlé of Vevey, so largely used in this country, were conspicuous.

The most notable exhibits of Denmark and Sweden were their cream separators, the Burmeister and Wain of the former country

and the Laval of the latter, with which everybody interested in dairying is familiar.

The Belgian exhibit in this particular class was small. M. Louis Frennet-Wauthier, of Ligny, exhibited a machine for raising and cleaning beet-root, which was reported by a number of the Jury, who had seen it in operation, to do its work well. It was evidently much too heavy, and it requires further modification. M. Pierre Tixhon-Smal, of Herstal-lez-Liège, exhibited a 4-horse gear and threshing machine with side delivery beaters. There was a considerable show of Belgian dairy plant; but this did not come under Class 35.

The Russian exhibits of most interest were those made by the "Ministère de l'Agriculture et des Domaines, Section des Améliorations du Sol," of St. Petersburg, and by the "Société de Lovitch pour les Produits et Engrais Chimiques," of Warsaw. The machines shown, though no doubt suitable for local requirements, were of a rough nature, not comparable in finish with the exhibits of other countries. This may conclude the review of the Continental agricultural implements, as the remaining exhibits were entirely unsuited to the requirements of British Agriculture.

In concluding this brief notice of the Agricultural Implements at the Paris Exhibition, I desire, without associating myself with any particular award, to bear testimony to the very careful and impartial consideration given to the exhibits by the Jury as a whole, and also to acknowledge the courtesy and consideration with which any suggestions I put forward were received. I also desire to express my obligations to the several exhibitors for the information they provided, and to thank Mr. Godfrey, Secretary of the Central Chamber of Agriculture, for having collected many of the statistical figures given above.

F. S. COURTNEY.

Broad Sanctuary Chambers, Westminster, S.W.

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## THE CHEMICAL CHANGES IN THE MANUFACTURE AND RIPENING OF CHEESE.

THE manufacture of cheese involves processes of both chemical and biological nature, which are of extreme variety and intricacy. From a material which is of fairly constant composition—viz. the milk of the cow—cheeses which are of very different degrees of richness, and which exhibit very great varieties of flavour, can be prepared. The processes of the manufacture regulate the kind of cheese produced and the quality which any particular cheese possesses, and these processes are more or less under the control of the dairyman who carries out the operations.

While there is, however, a general course of procedure which with various modifications is almost universally followed, the final product depends to a very large degree upon the nature of the chemical changes which are produced in the substance of the cheese during the period devoted to what is known as its *ripening*, a period which lasts for a longer or shorter time in different cases.

The initial process in cheese-making is invariably the same—the so-called *curdling*, or the transformation of the great mass of the milk into a jelly-like material, from which a generally clear acid liquid slowly drains away.

### COMPOSITION OF MILK.

Milk as drawn from the cow is of tolerably complex character. Its great value for nutritive purposes lies in the fact that it contains representatives of all the foodstuffs which the animal body needs for its sustenance, and in about the correct proportions. Its composition may be taken to be, for every 1,000 parts: proteids 35, fat 39, sugar 47·5, inorganic salts 7·5, water 871. It is an emulsion, the fats existing in the form of globules of varying, but minute, size, each probably protected by a thin envelope of proteid. It is this condition of the fat which gives to milk its peculiar white colour.

The emulsion is not a permanent one, for, on standing, a good deal of the fat rises to the top of the liquid, being then separable in the form of cream. Sufficient, however, always remains in

the body of the milk to enable it to retain its peculiar appearance.

The sugar which milk contains is the variety known as lactose, or milk sugar. It has a very similar composition to cane sugar, and when it is acted upon by dilute mineral acids such as sulphuric acid it splits up into equal parts of two other simpler sugars known as galactose and glucose. It is capable under particular circumstances of being converted into lactic acid.

It is, however, the proteids with which we are most concerned when we consider the manufacture of cheese, for it is in these that the most profound and the most varied changes occur. Proteids differ from all the other food-stuffs in containing nitrogen in combination, and in that particular approach somewhat nearer to the composition of living substance itself. There are several kinds of these bodies, which differ from each other in their degrees of solubility and in their power of passing, while in solution, through animal membranes. The proteids with which we are perhaps most familiar are the albumin of eggs and of blood, and the globulin or myosin of flesh. Those which are contained in milk are mainly two, an albumin very much like that of white of egg, and another proteid peculiar to milk, known as *caseinogen*. The latter is present usually in the proportion of 30 parts out of the total 35 per thousand, and is the body chiefly concerned in the production of cheese.

#### FORMATION OF CURD.

When milk is allowed to stand exposed to the air certain changes take place in it after a few hours. It first becomes slightly acid, and when a certain degree of acidity is reached, a process of curdling takes place. The greater part of the proteid is thrown out of solution in a peculiar jelly-like form, and generally so completely is the effect produced, that the bulk of the milk appears to be transformed to a jelly. After a time the jelly shrinks or contracts, and a watery liquid known as *whey* can be squeezed out of it.

In the manufacture of some kinds of cheese the process is allowed to commence in this way. The caseinogen is made to separate out in the form of this jelly or curd by the action of the acid which appears in the liquid on standing. The acid is lactic acid, and is produced in the milk by the action of certain bacteria or germs, which are almost universally present in the air, and which speedily make their way into the milk. The caseinogen is thrown out of the solution by the acid which these

germs form from the milk sugar, and is not chemically changed in the process. It can be broken up and dissolved in weak saline or alkaline solutions, and again thrown down by acidification as before.

#### ACTION OF RENNET.

A much more profound change, however, is brought about in the caseinogen in the ordinary processes which are followed in the preparation of cheese. The addition to the milk of a peculiar substance known as *rennet* is followed by a somewhat different process of curdling or coagulation. The rennet causes the formation of a jelly which appears very much like the one produced by acid, and for a long time the two were thought to be identical. There is, however, a very important chemical difference between them.

The original proteid caseinogen splits up under the influence or by the action of the rennet into two other proteids, one of which constitutes the curd of the jelly, while the other remains in solution in the whey which the curd contains, and which is squeezed out of the jelly as the latter contracts on standing.

This change, or decomposition, of the caseinogen is dependent on the presence in the milk of a certain proportion of calcium salts, chiefly the phosphate, which forms part of the quantity of inorganic salts already noted as in solution there. It is not quite certain how the lime salt influences the process of coagulation or curdling, but the proteid of the curd, known now as *casein*, differs from the caseinogen, or proteid of the milk, by containing a relatively large amount of calcium phosphate in some kind of combination with it.

The cheese made from milk after curdling by acid differs thus in two respects from that made by rennet. It is much more strongly acid at the outset, on account of the formation of the lactic acid, and its fundamental proteid, constituting the bulk of the curd, is caseinogen, and not casein.

Caseinogen can be separated from milk by the action of acid without curdling. If a somewhat strong reaction is produced in the milk by adding a mineral acid to it, this proteid separates out in dense flocks, and not as a jelly. The flocks can be filtered off, washed, and dissolved in a weak alkali, and then the proteid can be made to undergo the other decomposition by the addition of rennet and a little calcium phosphate, a jelly of true casein being formed just as if the natural milk had been acted on.

## NATURE AND SOURCE OF RENNET.

Rennet is a substance which belongs to the group of bodies known as *enzymes*, or unorganised ferments. These are substances which play a very important part in the processes of digestion, both in the animal and the vegetable body, but they are so difficult to prepare in a pure condition, that we know hardly anything about their composition, and not much about the way in which they bring about the decompositions which they set up. The chief source of rennet is the inner coat of the wall of the stomach, and it exists in largest quantity in the stomach of young animals, particularly the calf. The inner coat of the organ contains an innumerable quantity of tubular pits, which open on the surface. Each pit constitutes a gastric gland, and is composed of a delicate membrane, on which are placed a number of cells, or masses of protoplasm. These cells prepare from the blood a faintly acid liquid known as gastric juice, and they pour it out into the cavity of the stomach as digestion begins. The juice contains very considerable quantities of two enzymes, one of which is the rennet now under discussion, and the other is the so-called *pepsin*, of which it will be necessary to speak later. The rennet of commerce is prepared from the coat of the stomach with the glands *in situ*. The organ is minced finely either in the fresh state, or after dehydration by alcohol, and the pulpy mass is extracted with an appropriate solvent, usually a solution of a neutral salt. Sometimes the coat is dried and powdered; sometimes it is used without more preliminary preparation.

By all these methods the two enzymes, rennet and pepsin, which are formed by the gland cells, are extracted together in the preparation. It is, however, possible to separate them more or less completely from each other, but the process generally entails a considerable loss of both. That most generally adopted was discovered by Hammarsten, a Danish physiologist, in 1872. It consists, in the first place, of a fractional precipitation of an acid aqueous extract of the stomach by means of magnesium carbonate, or a solution of acetate of lead. Both pepsin and rennet are thrown down by these reagents, but pepsin is precipitated with the greater readiness. It is possible, therefore, to free the liquid from pepsin, while the greater part of the rennet remains in solution. After filtering off the pepsin, further addition of the lead acetate throws down the rennet, the process being facilitated by the simultaneous addition of a little aqueous ammonia. The precipitate can then be filtered off, and purified by a further treatment.

A different method was introduced in America by Blumenthal in 1886. In his process the stomach of the calf is cut into small pieces, and steeped for twenty-four hours in a solution of common salt containing 5 grammes per litre (5 parts per 1,000) kept at about 85° F. A certain quantity of proteid matter goes into solution with the enzymes in this salt liquid. After filtering from the undissolved material, one part of some mineral acid is added to each thousand parts of the solution, when a thick precipitate of mucous matter is formed, which can be separated mechanically, leaving the two enzymes in solution. About four times the original quantity of acid is next added, and the liquid is saturated with powdered common salt. It is kept for two or three days at a temperature of about 70° F. with constant stirring, and the temperature is then raised gradually to about 95° F. After standing for some time a white flocculent scum separates out, which can be removed by skimming, and dried at a fairly low temperature. This precipitate, which is without taste or smell, and which readily dissolves in water, is almost pure rennet. The mother liquid from which it is removed has no curdling action, but is possessed of very considerable peptic powers.

#### CONDITIONS OF ACTION OF RENNET.

The enzyme rennet is active in neutral or in faintly acid or alkaline solutions, but the clotting has been found to occur most readily when a little acid has been present, provided that not enough has been added to precipitate the caseinogen. In the manufacture of cheese on a commercial scale, the presence of a little acid has been found to be of considerable advantage, and to have a very important influence on the subsequent changes which we are about to consider, which constitute what is known as the *ripening* of the cheese. It is usual to allow the milk to stand until a certain degree of acidity has been developed in it rather than to add any free acid. If milk is allowed to stand exposed to air, as we have already seen, the lactic germs present in the air make their way into the milk and slowly convert the milk sugar into lactic acid. These germs are greatly influenced by temperature, the most advantageous degree being realised when the night's milk to which the morning's milk is added has been standing at about 65° to 70° F. This exposure will have produced about the most favourable degree of acidity. The effect of the acidity is not only to assist the working of the rennet in the curdling, but to aid in the separation of the whey from the curd. It has also

an influence on what is known as the *texture* of the cheese, which is an important factor in the subsequent changes of ripening.

The most favourable degree of acidity varies according to the kind of cheese that is to be made. Cheese which is intended to be consumed very speedily, and which must therefore ripen quickly, is usually made from milk in which the acidity is fairly pronounced; in cheese which is intended to be stored some time the development of acidity is prevented as far as possible. In the manufacture of Brie cheese, the coagulation is conducted very slowly, a very small quantity of rennet being used and the milk being allowed to become distinctly acid before the rennet is added to it. Indeed the production of the curd in this case is held to be due jointly to the acid and the enzyme.

The occurrence of rennet in the inner or mucous coat of the stomach of young animals whose food is mainly milk appears to point to its being an adaptation especially connected with the latter. It is, however, not by any means confined to the stomach, but has been prepared from the pancreas of several animals, especially the pig, ox, sheep, horse, dog, and cat; also from the human pancreas. It exists in small quantity in many organs of the body, including the liver, lung, kidney, spleen, thymus and thyroid glands, brain and intestine. It is not confined either to animals whose food at some time or other is milk, for it has been detected in the stomachs of the cod-fish and of the pike, the digestive organs of the fowl, and the pancreas of the eagle. It has also a wide distribution in the vegetable kingdom, occurring in many plants and many different parts or organs of plants. It is especially prominent in many seeds, among which may be mentioned *Withania coagulans*, a near relative of the potato, which grows in Afghanistan; the thorn-apple, *Datura Stramonium*, another member of the same family; *Ricinus communis*, the castor-oil plant; and several members of the pea and bean tribe. It is yielded also by several of the filamentous fungi, or moulds, and by many bacteria or germs. It has not yet been discovered what is its purpose in the vegetable kingdom, the only property so far attributed to it being its power of curdling milk, which we have been discussing.

#### PRESENCE OF RENNET IN MILK.

We have already noted the fact that if milk is allowed to stand in contact with the air it becomes infected with the lactic germs or bacteria, its reaction becomes acid, and the caseinogen is presently coagulated, a soft curd being formed. In all probability this is not the only change which takes place.

If antiseptic substances, such as chloroform or ether, are added to milk the action of the germs becomes impossible. They cannot live in the presence of these antiseptics. Milk treated in this way, even if kept from further exposure to the air, will, however, curdle in a few days without any material increase in acidity, and the rapidity with which the change will occur has been found to depend to a certain extent on the temperature. This behaviour appears to show that the milk itself as it leaves the cow contains a very small trace of rennet, for the clotting is a normal one, though taking place very slowly, and the curd has all the characters of one produced by the enzyme. Moreover, the latter is not affected, as the germs are, by the presence of antiseptics.

We see thus that a normal curd or cheese is mainly composed of the caseinogen of the milk, changed by the enzyme rennet into casein, and consequently holding a certain part of the calcium phosphate which was originally dissolved in the milk. This can be detected indeed by an analysis of the cheese. It contains also the fat or cream, which adheres closely to the curdled proteid unless the fat has been previously removed by skimming or separation. The liquid whey, which gradually leaves the curd as the latter shrinks on standing, contains the sugar and the rest of the inorganic salts, as well as the albumin originally present and the whey proteid, *lactalbumin*, produced by the splitting of the caseinogen as already described. The whey should leave the curd as a greenish-yellow transparent liquid, nearly or quite free from milkiness. As it is not entirely removed, the cheese contains some of the sugar and inorganic salts.

The treatment of the curd after it has been formed varies very considerably in the manufacture of the different kinds of cheese. In some cases it is carefully broken up into minute pieces and treated with whey warmed to particular temperatures, well stirred and allowed to harden till it is of a crumbly consistency. In other cases the whey is allowed to drain away to a considerable extent before the curd is cut. The details of the treatment are, however, outside the scope of the present article. In all cases the preliminary treatment is carried out till a particular degree of acidity has been secured, before it is ready for salting and for transference to the cheese press.

#### THE CHANGES IN THE CHEESE WHICH CONSTITUTE RIPENING.

The character and quality of the cheese depend upon subsequent changes which are included in the term *ripening*.

These changes involve alterations in the texture of the cheese and the development of the particular flavours which are characteristic of the different kinds.

During the process of ripening, the sugar which remains in the curd is converted with some readiness into lactic acid and other products. The fatty constituents and the inorganic salts undergo but little change, but the former are often considerably increased by some of the changes which occur in the proteids.

The greatest alteration takes place in the latter, a very complicated system of decompositions being set up by various factors. The texture of the cheese is first affected, the development of particular flavours taking place subsequently.

To understand the changes which the proteids undergo it is necessary to follow the course of digestion which takes place in the body after such substances have been eaten, for there is a striking similarity between the two processes. The ordinary proteids of a natural diet consist very largely of globulins such as occur in the flesh of animals, of albumins, such as the uncooked white of egg, and of caseinogen, the proteid of milk and curd. When eaten these pass into the stomach of the animal, and are there mixed with an acid fluid secreted by its walls, and known as gastric juice. As they are eaten they are unable to make their way into the walls of the stomach, and so to enter the blood stream. With the exception of the albumins they are insoluble in the gastric juice until they undergo the process of digestion. When they have been subjected to heat, as in the operations of cooking, they are, with the exception of the milk proteid, converted into a singularly insoluble condition. The first process of digestion is to change them into soluble proteids which can be dissolved in the liquid in the stomach.

If the change was arrested at this point, however, but little progress would have been made. They cannot nourish the tissues of the body without being introduced into the blood-stream. As the latter is flowing in vessels with very evident walls which are not perforated, the nutritive material can only enter the latter by a process of soakage or diffusion. This demands another peculiar property which they must possess, viz. the power of passing through a delicate homogeneous membrane. In the stomach wall a number of these capillary blood-vessels are distributed, but before a stream of liquid from the interior can reach them it must pass also through the inner coat which lines that organ. This is composed of a delicate membrane not unlike that of the blood-vessel, but covered over with a layer of cells which constitute what is called an *epithelium*.

The same process of absorption of digested material takes place in the small intestine or bowel, which communicates with the stomach and receives the unabsorbed food after a stay of some few hours in the latter. None of these proteids which we have mentioned has the power to diffuse through these membranes.

The method by which substances which are diffusible pass through the membranes can easily be examined outside the body. If a narrow glass tube is closed at one end by a piece of bladder or parchment fastened round it so tightly as to prevent the escape of any liquid, and a quantity of syrup is put inside the tube, and the bladder then immersed in a vessel of water, the quantity of liquid in the tube soon begins to increase. A certain quantity of water makes its way through the bladder and mixes with the syrup. Simultaneously a smaller quantity of the syrup makes its way through the bladder and mixes with the water, where its presence can be detected by the ordinary chemical tests for sugar. We have thus two streams passing through the bladder in opposite directions, the rate of the two differing. For the experiment to be successful it is essential that the bladder shall be quite free from any punctures or holes. The process is an ordinary physical one, and is known as *osmosis*.

The experiment practically represents what takes place during the absorption of digested food. The bladder is represented by the wall of the stomach, and the delicate membranes of the capillary blood-vessels; the water by the liquid of the blood and lymph in the vessels and tissues of the stomach wall; and the syrup by the digested materials which are to be absorbed.

For any proteid substances to be absorbed, therefore, and so to become available for the nutrition of the body, they must be soluble, and the soluble proteids must have the power of diffusing through the membranes spoken of, in the ordinary course of osmosis.

As we have seen, the ordinary proteids of food, whether cooked or raw, do not fulfil these conditions. The various processes of digestion bring about such changes in them that the insoluble indiffusible proteids disappear and are replaced by others which possess these properties.

The first of these changes takes place in the stomach. The gastric juice which oozes into this organ from the glands which we have seen line its inner coat contains a peculiar enzyme, known as *pepsin*, together with a small quantity of hydrochloric acid. This changes the insoluble proteids into a material known as *albumose*, and this again into another similar one termed *peptone*, which has the characters needed.

In digestion, however, the changes are not completed in the stomach, but after a stay of two to four hours the partially digested contents are passed on into the small intestine. Almost immediately a quantity of another digestive juice, formed by the pancreas, is poured into this organ. This liquid is alkaline, and contains another enzyme, known as *trypsin*, which acts in the same way as pepsin, but even more energetically. The proteids which have not been converted into peptone in the stomach undergo the change under the action of the trypsin, and the peptone itself is further decomposed, certain simpler substances being formed which are crystalline in character, and which, from the condition in which their nitrogen is contained, are known as amido-acids. There are several of these bodies, the most prominent of which are known as *leucin* and *tyrosin*. These are very readily diffusible, much more so indeed than the peptone from which they arise. By the time that the pancreatic juice has finished its work, the original insoluble proteids of the food have been converted into the soluble and diffusible forms of peptone, leucin, and tyrosin. The relative proportions of these varies considerably, and the readiness with which each ministers to the nutritive processes is still a matter of controversy.

The changes which the proteids of the cheese undergo during the process of ripening are the same as those which have just been described. Ripening so far as these are concerned is indeed a process of auto-digestion. If a cheese is examined at relatively short intervals during ripening these various bodies can be ascertained to make their appearance successively. The casein produced by the rennet from the caseinogen gradually diminishes in amount, albumose, peptone, and leucin and tyrosin in turn making their appearance. The process does not stop, however, at the formation of leucin and tyrosin, but a small amount of free ammonia is formed. The rate of this auto-digestion is very much slower than that of digestion in the alimentary canal, which may be attributed partly to the relatively small quantities of the exciting ferments and partly to the fact that the changes are taking place in a solid substance and not in a liquid medium.

The stages of the process as thus described have recently been investigated in the Bohemian Harrach and Konopister cheeses by Laxa. Analyses were made of the cheeses when fresh and at different stages of ripening, and special determinations were made of the different forms of nitrogenous compounds present, viz. the unaltered casein, the albumoses, the peptone,

the leucin and tyrosin, and the ammonia, and the course of the changes was ascertained to be that just described.

Certain changes in the other constituents were also determined, the consideration of which may be deferred for the present.

#### THE DIGESTIVE CHANGES INDEPENDENT OF GERMS OR BACTERIA.

The changes in the proteids associated with the ripening of cheese will take place also in milk if it is kept perfectly free from the presence of putrefactive germs. Some experiments made a few years ago by Messrs. Babcock and Russell at the agricultural experimental station of the University of Wisconsin, U.S.A. are especially interesting in this connection. They collected milk from the udders with strictest precautions against the entry of germs, and mixed it with various antiseptics in such proportions as experiment had proved to be fatal to all such microbes, the antiseptics including chloroform, benzol, thymol, sodium fluoride, and salicylic acid. They then examined it at certain intervals, analysing definite samples. They determined in each case the total nitrogen it contained at the outset, which gave them the amount of proteid present, nitrogen not existing in fresh milk in any other form, and the quantity present in proteid being known. At the same time they ascertained the quantity of caseinogen present and the amount of nitrogen contained therein; also the amount of albumose and peptone, which again they expressed in terms of the nitrogen in those compounds. As the milk grew older the soluble and diffusible albumoses and peptones increased in amount, while the caseinogen diminished. In the fresh milk, 12 hours old, 76 per cent. of the total nitrogen was in the form of caseinogen, and 10 per cent. in that of albumose and peptone; in milk 8 days old the caseinogen was to the albumose and peptone in the proportion of 64 to 24; in milk that had been kept 20 days, the proportions were 59 to 29. In another series of experiments the milk was preserved for 300 days and the nitrogen in the form of albumose and peptone rose from 16 to 78 per cent. of the total nitrogen of the milk.

The investigations of Laxa, already referred to, confirm those made by other observers whose researches call for notice in this connection. The progress of investigation has been slow, but the different data have been accumulating for many years. Leucin, one of the products of the decomposition of peptone, was first prepared from ripe cheese as long ago as 1818. Its companion tyrosin escaped observation till 1880, when it was

detected in Roquefort cheese by Sieber. Analyses of cheese in different stages of ripening were made by Weidmann in 1882 and by Röse and Schulze in 1888. The researches of the last mentioned observers were made upon Emmenthal cheese, which is consumed so freely in South Germany and Switzerland. Like Laxa, these observers found both leucin and tyrosin present, the former being, however, in greatest amount. Ammonia also occurred, different samples containing from .16 to .44 per cent. calculated on the dry weight of the cheese. About one fifth of the total nitrogen of the cheese was found to exist in these forms, so that the digestion of the caseinogen was very far advanced. There was a considerable quantity of peptone, or of a body differing very little from true peptone, to which the name *caseo-glutin* has been given. Bodies of this class constituted about 20 per cent. of the total dry matter present, while there was a considerable quantity of unaltered casein.

Analyses of other kinds of cheese have shown the same general course of events during ripening. Spaten cheese contains almost exactly the same chemical substances as Emmenthal; Gruyère is fairly rich in peptone. When Gorgonzola is allowed to become over-ripe, as much as six sevenths of its total nitrogen has been found to be present in the form of amido-acids such as leucin and of compounds of ammonia, leaving only one seventh in the form of proteid.

#### FATE OF THE MILK SUGAR.

Turning from the proteids to consider briefly the fate of the other constituents of the curd, we have seen that a certain amount of the whey is retained in its substance, and that during the preliminary treatment some of the sugar this contains is converted into lactic acid. By the action of other germs, or in some cases by the aid of filamentous fungi or moulds, this lactic acid is consumed. The acidity in any case is destroyed in consequence of the development of the ammonia which we have seen results from the decomposition of the proteids. The sugar in most cases disappears entirely through these agencies. Sometimes some of the lactic acid is converted into butyric acid by a special microbe or germ, with the result that the cheese acquires a bitter flavour.

#### FATE OF THE CREAM.

The last important constituent of the cheese to consider is the fat. The whole of the fat or cream of the milk is usually

retained in the curd, and in the manufacture of some kinds of cheese, such as Stilton, a considerable quantity used to be added before the curdling was allowed to take place. In ordinary whole-milk cheese the percentage of fat present is rather more than that of the casein.

During the ripening the fat suffers no great change as a rule, though in some cases its quantity is increased by a decomposition of part of the proteid. This was first noticed in 1864 by Blondeau in the course of his investigations on Roquefort cheese. The transformation appears to be due to the action of some of the lower fungi. In certain cases again a chemical change or decomposition of the fat can be observed, which sometimes leads to the development of a rancid flavour. Fat is composed of organic acids of some complexity known generally as fatty acids, which are combined in a particular manner with glycerine. Among the fatty acids of milk may be mentioned butyric and caproic acids, which are volatile. When such a fat is exposed to light and air and consequently to the crowd of micro-organisms which the latter contains, it undergoes a splitting into the two constituents, the fatty acid and the glycerine. The fatty acids then undergo further changes, uniting in different proportions with the oxygen of the air and splitting up in various ways. These changes are commonly referred to as *rancidity*. In many cases the fat in cheese is affected by them in various degrees. The separation of the fat into fatty acid and glycerine, known as *saponification*, frequently takes place, while the subsequent development of the rancid flavour by the oxidation of the fatty acid is not uncommon. Duclaux found in one particular cheese that about one third of the fat present was broken up into its two constituents.

#### CAUSES OF THE CHANGES IN THE PROTEIDS.

##### 1. *Action of Bacteria.*

During recent years very great attention has been paid to the changes in the proteids which we have described, with a view to ascertaining the nature of the agencies by which they are brought about. At first they were thought to be purely chemical, but the great development of bacteriology, which has been the result of Pasteur's discoveries, has led to the view that they are mainly the work of microbes or germs. The earliest writer who attributed the ripening of cheese to the activity of these organisms was Cohn, who published his views in 1875. He associated the changes with the bacteria which at that time were grouped together

under the name *Bacillus subtilis*, a group which has since been found to consist of several different organisms. The decompositions were attributed by many observers to the germs which convert milk sugar into lactic acid, and which were consequently known as lactic bacteria. It was observed that though other bacteria were present in the milk, the lactic forms gradually suppressed them. The lactic bacteria have been found to develop with enormous rapidity at first, to maintain themselves for a varying time, and then to diminish in number rapidly. The casein softens during the period of increase, and this coincidence has led the commencement of ripening to be attributed entirely to their influence. It must be remembered, however, that the milk, after standing exposed to the air for some time, is infected by many different species of bacteria besides those which form lactic acid from sugar. Many authorities state further that when pure cultures of lactic bacteria are employed the proteids remain unchanged, so that the lactic organisms have no power of forming peptone and the other nitrogenous bodies found in the cheese.

In 1878 attempts were made by Duclaux to obtain pure cultures of the different bacteria found in cheese, so as to test the powers of each kind separately. He worked on Cantal cheese, from which he extracted ten different species, all of which belonged to the large group of the hay bacilli. Nine of the ten forms were found to be able to set up the changes in the proteids, while the other had no such power. Duclaux grouped these forms together in the genus *Tyrothrix*, each one constituting a distinct species. The most energetic he named *Tyrothrix tenuis*, an actively motile rod-like bacillus, often growing in the form of filaments. When the organisms were cultivated in milk or curd, quite free from any other germs, they gave rise to leucin, tyrosin, and compounds of ammonia, to the products, in fact, which we have seen to be present in great abundance in ripened cheese. It seems probable, therefore, that so far as bacteria are concerned, it is these forms, and not the true lactic bacteria, which set up the changes.

This view, however, is by no means universally accepted. It has been opposed by many well-known observers, among whom may be mentioned von Freudenreich, who studied the ripening of Emmenthal cheese, the chief Swiss product, and Lloyd, who investigated the manufacture of Cheddar. The latter writer says emphatically that to make Cheddar cheese of excellent quality, the *Bacillus acidilactici* alone is necessary; other germs tending to make the work more, rather than less, difficult.

## 2. Action of an Enzyme.

Duclaux attributes the action of the *Tyrothrix bacilli* to a soluble ferment or enzyme, which they form in their living substance, and pour out into the medium in which they are found. If a pure culture of this organism is treated with a large excess of alcohol, a precipitate is formed which contains the enzyme. If it is allowed to stand under alcohol for some time, and is then dried and subsequently extracted with water, the enzyme goes into solution in the water. The solution can then be freed from insoluble matters by filtration, and if some of it is now added to sterilised milk or curd, it sets up the changes in the proteids in exactly the same way as the *Tyrothrix* itself. Weigmann also states that the enzyme can be prepared from bacterial cultures, and that, when added to fresh cheese, it accelerates its ripening, just as do the organisms themselves.

Duclaux has named this enzyme *casease*; it belongs to the group of *trypsins*, of which the best known member is the trypsin of pancreatic juice, whose action in digestion in the alimentary canal has already been described.

## THE ENZYMES OF FRESH MILK AND THEIR ACTION.

Some experiments carried out in 1897 by Babcock and Russell at the agricultural experiment station of the University of Wisconsin have thrown a new light upon the process, and have shown that if bacteria play an important part in these digestive changes, they are not the only agency at work. These researches have already (p. 684) been incidentally alluded to in considering the changes which take place in milk which has been preserved for a considerable time through the addition of antiseptics such as chloroform. We saw that the caseinogen was gradually peptonised till more than 70 per cent. of it had disappeared. The presence of antiseptics preserved the milk from contamination with bacteria, so that the causes we have just considered were not operative. Antiseptics in the proportions used are not obstacles to the activity of enzymes—indeed, are generally used to distinguish between the action of the latter and that of bacteria. It appeared probable, therefore, that the action was due to the presence of an enzyme. One of the features of the behaviour of the latter class of substances is that they are rendered incapable of setting up any change if they are heated to about 160° F. while in solution. Babcock and Russell found that raising the milk to this

temperature before adding the antiseptics effectually prevented the peptonisation of the caseinogen. The two sets of experiments together established the fact that in these milks the changes in the proteids were due to enzyme action, and as no enzyme or anything that could give rise to one had been added to the milk, the latter must have contained it as it left the cow.

We have already seen that other experiments had led to the conclusion that milk normally contains a little rennet. It appears, therefore, to be the seat of two enzymes, just as is gastric juice. They are present, however, in very small quantities, and only make themselves apparent if putrefactive changes are rendered impossible by the use of preservative fluids, such as chloroform.

There is nothing at all improbable in the view that these enzymes, and particularly the peptonising one, should be contained in milk, though up to the date of these researches their presence had not been suspected. Small quantities of pepsin are known to be present in many of the tissues and fluids of the animal body, even in the blood and in the fluid of muscle.

The enzyme under discussion might be expected to be capable of demonstration in ripening cheese if the milk originally contained it. Babcock and Russell placed a newly made cheese under chloroform and kept it under observation for more than a year, so that it was heavily saturated with the antiseptic. Examination of it by the usual bacteriological methods proved that it was quite free from organisms. Yet the changes of ripening went on exactly as in a normal cheese. At the end of a year more than fifty per cent. of its casein was converted into soluble products, partly albumoses and peptones, partly leucin and tyrosin. The amount of all these substances was found to be very near that found in a normal cheese of the same age.

In another experiment they impregnated a milk with ether, adding rennet to it at the same time. It was curdled by the latter quite normally, and formed practically a whey-soaked cheese. After four months the curd which was produced had gradually dissolved and nearly half the casein had been converted into albumoses and peptones, with a certain quantity of leucin and tyrosin.

Attempts were next made to extract the two enzymes from milk with a view to seeing if they could be made to set up the curdling and the peptonising processes in a fresh sample. One of the properties of enzymes in general is that they attach themselves somewhat closely to finely divided material in their

solutions. Pepsin can be extracted from gastric juice by causing a fine precipitate to form in the liquid, when the enzyme clings to the minute particles and can be removed by filtration, leaving the fluid without any digestive power. Babcock and Russell took advantage of this property by passing the milk through a cream centrifugal separator. The enzymes attached themselves especially to the fine particles of the slime of the separator. The latter was mixed at once with a quantity of dilute alcohol containing 40 per cent. of the spirit, and antiseptics were added to prevent the access of bacteria. After twenty-four hours it was filtered, yielding a clear liquid, free from any particles. This filtrate was then evaporated to one tenth of its original bulk in shallow dishes, the temperature being maintained at 85° F. and more antiseptic being added as a precautionary measure. The solution contained a certain quantity of soluble proteid, which was removed by the ordinary procedure. After this removal it was found to have the power of curdling milk like an ordinary rennet solution, and further to be able to dissolve the curd when allowed to stand.

Experiments were made subsequently to examine its action on normal milk in some detail, and in particular its power of digesting or peptonising casein. It was mixed with milk under various conditions and allowed to act for twenty-one days. The nitrogen in the milk in the form of casein and that in the form of albumoses and peptone were then determined. As a control the behaviour of milk to which none of the solution was added was also examined. In this case the peptone increased from 15 per cent. of the total proteids to 35 per cent. Milk to which the extract of the slime was added showed that its peptone increased from 15 to 60 per cent. in the same time. When the slime extract was boiled before adding it to the milk the increase in the peptone was about the same as in that to which no slime extract had been added. This agrees entirely with the view that the latter contained a peptonising enzyme, as this body would have been destroyed by the heating.

The slime extract was in subsequent experiments ascertained to have the power of liquefying gelatin, a property which is possessed by peptonising enzymes.

Its general behaviour showed this new enzyme to be capable of carrying on the digestion of casein so far as to form leucin and tyrosin after the first production of albumoses and peptones. In this respect it behaves similarly to trypsin, the active constituent of pancreatic juice. Whether or no it is identical with the latter remained for a time uncertain, but in the following year the same observers published the results of some experiments

which show that though much like trypsin, it possesses features which point to its being an enzyme specially characteristic of milk and not occurring elsewhere. They have consequently given it the name *galactase*.

The chief respect in which it differs from the trypsin of the pancreas is that it not only forms leucin and tyrosin in addition to peptone, but it decomposes some portion of these bodies, giving rise to a certain amount of free ammonia. The formation of this gas can be observed when the enzyme is caused to act upon milk as well as when it is made to digest cheese. This feature of its action explains the fact already noticed that ripening cheese contains ammonia, which is generally found in combination with the acids proceeding from the bacterial action at the expense of either the sugar or the fat. Galactase differs slightly from trypsin also with regard to the temperatures at which its action is most energetic.

There still remains a question as to the structures in the body in which the enzyme is formed. It seems most probable that it arises in the cells of the mammary glands which secrete the milk. In most cases of the formation of the digestive ferments such structures are the seat of their origin, and in nearly all they have been prepared from the gland cells as well as from their secretion. This is particularly easy in the case of the pepsin and rennet of the stomach and of the trypsin of the pancreas. No observations have, however, been made up to the present on the mammary gland.

Another view has been suggested by Barthel, to the effect that they arise in the lymph cells or leucocytes which are found in milk, and which can be readily detected in the slime of the separators. There is little evidence so far for this view, but the balance of probability is rather against it.

There is a good deal of similarity between Babcock and Russell's galactase and Duclaux' casease from the *Tyrothrix bacilli*. The former observers go so far as to say that they are identical, and that Duclaux is in error in attributing the formation of the enzyme to the bacteria. This must, however, for the present remain undecided.

Some amount of evidence exists in favour of the view that the ripening of the cheese is not in all cases brought about by the same agency, but that all the factors we have considered are capable of playing a part in the process. The lactic acid bacteria, which were formerly thought to be all-important, seem undoubtedly to take a much smaller share in it. The most staunch supporter of this bacterial theory has admitted that galactase may possibly prepare the casein for their action, but

claims that they subsequently complete the decomposition. The universal presence of both lactic and peptonising bacteria in milk that has not been specially protected against their invasion, and their well-known powers in setting up these different decompositions, render it difficult to shut our eyes to the probability that they normally have a good deal to do with the process of ripening, though it may be freely admitted that the natural enzymes of milk can initiate and carry out the changes unaided.

#### DEVELOPMENT OF SPECIAL FLAVOURS IN CHEESE.

Two other most important features of the ripening of cheese are the development of the particular odours and flavours which are characteristic of the different kinds. At the outset the curd is practically without either smell or taste, and the preliminary souring only gives rise to the odour of lactic acid. As the changes we have discussed go on the development of the special characters of the particular cheese takes place. Very little comparatively is known about either of these features; but there is little doubt that they are brought about by the activity of lowly vegetable organisms, in some cases bacteria, in others filamentous fungi or moulds. In certain cases characteristic odours are produced by the mechanical incorporation of particular substances with the fresh milk or the newly-formed curd, as in the case of the so-called sage-cheese and clover-cheese. This is, however, outside the particular phase of the subject now under consideration.

Freudenreich states in his most recent paper that the flavour of Emmenthaler cheese is due to the lactic bacteria. He proved this by inoculating small masses of curd from sterilised milk with several different organisms, and allowing them to ripen. Those containing the lactic bacteria were the only ones to acquire the normal flavour of the cheese.

Pammel discovered an organism, which he called *Bacillus aromaticus*, which, when inoculated into fresh curd, produced during the ripening process an aroma similar to that of clover-cheese.

The action of the lower fungi appears to be responsible for the peculiar flavour and aroma of Roquefort cheese. The organism which takes the largest share, if not the only one, in their development is the common green mould, *Penicillium glaucum*, which occurs so frequently upon jams, preserved fruits, &c. The spores of the mould make their way into the cracks of the cheese, finding an appropriate nutriment partly in the proteids and partly in the lactic acid of the early fermentative process. It grows abundantly, and permeates all the crevices which soon arise in the ripening mass.

Penicillium spores are almost universally present in the air, and will speedily settle on such substances as cheese. Why they specially thrive in Roquefort cheese does not seem very evident unless the other germs which are present in the curd prepare a specially advantageous food for the fungus. This is a point on which further investigation is much needed.

The dependence of the particular features of the cheese upon the presence of this mould leads to its being artificially sown in the fresh curd during the early stages of the manufacture. Cultures of it are made on bread, and when the production of spores is well established the whole mass is dried and ground. The resulting powder is then strewn between the separate layers of the sliced curd.

No investigation appears to have been made as to the special fungi characteristic of Stilton, Gorgonzola, and other cheeses which develop blue mould. There is little doubt, however, that these are closely allied to Penicillium if they are not identical with it. The flavours are not dissimilar, the slight variations depending probably upon small differences in the nutrition of the organism when cultivated on the different curds.

The organism which is the cause of the special flavour of Edam cheese has been ascertained to be a bacterium, the so-called *Streptococcus hollandicus*, which is concerned in producing the peculiar disorder known as "ropiness" in milk. The organism is mixed with the milk before the latter is curdled, generally by adding to it a small quantity of ropy whey before it is set for cheese.

The influence of various bacteria which from time to time obtain access to milk or to curd is frequently found to be very objectionable during ripening, leading to the development of flavours which are unpalatable. Some species of Duclaux' tyrothrix, particularly *T. geniculatus*, produce a bitter substance in both milk and soft cheese. Another bacterium, called *Micrococcus casei amari*, from its possessing this particular property, was isolated by Freudenreich from hard Swiss cheese. Many organisms have been isolated which can produce bitter flavours in milk alone. If these contaminate it before it is curdled the objectionable flavour is developed at the outset. It is probable that the peculiar flavours incident to particular kinds of cheese are seldom the work of a single agent, but that many co-operate together under various conditions. The nature of the several organisms and the special conditions under which they most advantageously develop the flavours remain subjects for investigation.

J. REYNOLDS GREEN.

Cambridge

# Official Reports.

## REPORT OF THE COUNCIL

TO THE

HALF YEARLY GENERAL MEETING OF GOVERNORS AND  
MEMBERS OF THE SOCIETY,

HELD AT THE SOCIETY'S HOUSE,

13 *Hanover Square, W.*,

ON THURSDAY, DECEMBER 13, 1900,

EARL CAWDOR (President) in the Chair.

THE Council have to report that the list of Governors and Members has undergone the following changes during the half-year which has elapsed since the Anniversary General Meeting in May last :—2 new Governors and 133 new Members have joined the Society, and 2 Members have been reinstated under Bye-law 12, whilst the deaths of 6 Life Governors, 52 Life Members, and 88 Annual Members have been reported. A total of 12 Members have been struck off the books under Bye-law 10, owing to absence of addresses ; 15 under Bye-law 11, for arrears of subscription ; and 33 have resigned.

2. The losses to the Society through the deaths of influential well-wishers and supporters have during the last half-year been unusually severe. Amongst other Governors and Members whose decease the Society has had to deplore are : H.R.H. the Duke of Saxe-Coburg and Gotha, Duke of Edinburgh ; the Duke of Wellington ; the Marquess of Bute ; Earl Howe ; Lord Hylton ; Lord Russell of Killowen ; Sir W. Cunliffe Brooks, Bart. ; Sir Gabriel Goldney, Bart. ; Sir John Lawes, Bart., F.R.S. (a Trustee of the Society) ; Sir A. W. Neeld, Bart. ; Sir J. Heron Walker, Bart. ; Sir Henry Simpson ; Admiral Maxse ; General Pitt-Rivers ; Mr. William Biddell, of Lavenham ; Mr. John Batten, of Aldon, Yeovil (a Foundation Life Governor of the Society, elected a Member of the English Agricultural Society on July 16, 1839) ; Mr. Alfred Castellain, of Liverpool (a Member since May 27, 1840) ; Mr. Alfred De Mornay ; Mr. T. Duncombe Eden (a Member since 1841) ; Mr. R. W. Eddison, of Leeds (who, as reported to the Members at

the Anniversary General Meeting held in May, had been nominated for a seat on the Council, but who died on the night before the date for his election); Mr. G. F. Muntz; Mr. Harry J. Hildyard; Mr. Samuel Rowlandson (a Member of the Council since 1889); and Mr. W. Sheraton (a former Member of the Council from 1878 to 1890).

3. The above and other changes bring the total number of Governors and Members now on the Register to 10,630, divided as follows:—

- 8 Foundation Life Governors (Members elected before the granting of the Charter on March 26, 1840);
- 71 Governors paying an annual subscription of 5*l.*;
- 97 Life Governors;
- 6,858 Members paying an annual subscription of 1*l.*;
- 3,450 Life Members;
- 121 Life Members by Examination;
- 25 Honorary Members;

10,630 Total number of Governors and Members, as against a total of 10,846 Members at the same period last year.

4. Two vacancies on the Council occurred during the autumn recess through the lamented deaths of Sir John Lawes and Mr. Samuel Rowlandson. The reputation of Sir John Lawes as a scientific agriculturist has been world-wide for many years; and his services to Agriculture at large during the whole of his long and useful life of eighty-six years merit the most grateful recognition by the members of the Royal Agricultural Society, on the Council of which he had sat for the unprecedented period of fifty-two years (1848 to 1900). The leading facts of Sir John Lawes' career have already been given in an obituary notice, from the pen of Dr. Fream, which appeared in the September number of the Society's Journal; but the Council wish formally to put on record in this report their deep sense of the irreparable loss to the agricultural community caused by Sir John's decease, and their high appreciation of the value of his researches at Rothamsted, the continuance of which after his death has happily been ensured through the munificent donation which he made to the Lawes Agricultural Trust in the year 1889. It was the wish of the Council on more than one occasion, and particularly in 1893, when the Jubilee of the Rothamsted experiments was celebrated, that Sir John Lawes should accept the Presidency of this Society. Though, in view of his deafness and advancing years, he felt unable to accept the compliment thus sought to be paid to him, Sir John manifested to the last the keenest interest in the Society's welfare, and the long list of articles which he and his collaborator, Sir J. Henry Gilbert, wrote for the Society's Journal constitute what is undoubtedly the most important series of contributions to that publication since its original issue in 1839.

5. The post of Trustee of the Society, vacated by the death of Sir John Lawes, has been accepted by the Duke of Bedford, to the generosity of whom and his predecessors in the title the Society is so much indebted for the maintenance of the Woburn Experimental Farm. The Earl of Derby has been appointed a Vice-President in the room of the Duke of Bedford, and Mr. W. A. Prout, of Sawbridgeworth, Herts, has been elected as a Member of the Council.

6. The vacancy caused by the death of Mr. Dan. Pidgeon earlier in the year has been filled by the election as a Member of Council of Mr. John Howard Howard, of St. Mary's House, Bedford. By the regretted death of Mr. Samuel Rowlandson, of Newton Morrell, Darlington, who had rendered conspicuous services to the Society during the nine years of active life (1889-1898) that he sat upon the Council, another vacancy has arisen which is now under the consideration of the Council.

7. In view of the presence in this country at the time of the York Show of Landrath von Etzdorf, Director-General of the East Prussian estates of H.I.M. the German Emperor, who had been officially sent to England to pursue some agricultural inquiries, it appeared to the Council to be fitting that the Society should show its appreciation in some special manner of the visit of the representative of His Imperial Majesty. Landrath von Etzdorf was accordingly elected at the Council Meeting held on May 30 an Honorary Member of the Society, and a very cordial telegram of thanks for this compliment was subsequently received from H.I.M. the German Emperor by H.R.H. the Prince of Wales, as President of the Society. In order to afford an opportunity for associating with the Society in an honorary capacity other distinguished representatives of agriculture in the colonies and abroad, the existing bye-law restricting the number of Honorary Memberships to twenty-five has been enlarged so as to give power to the Council to elect Honorary Members up to a maximum number of fifty, of whom not more than twenty-five may be British subjects.

8. The Society's sixty-first Meeting, under the presidency of H.R.H. the Prince of Wales, was held on the Knavesmire in the historic city of York, from June 16 to 22 last. The entries of live stock and implements were fully up to the average, and the quality of the exhibits was well maintained. The Show week was favoured on the whole with fine weather, and everything possible was done by the Lord Mayor and Corporation, the local Committee, the railway companies, and the officials of the Society to make the Show a success. The Meeting fully answered its primary object by bringing together a very fine and representative collection of live stock of the different breeds, and introducing to the notice of the public the latest developments in farm machinery and appliances. But it

nevertheless failed to attract a sufficient number of paying visitors to meet the expenses; and the final result of the holding of the Meeting, as certified by the Society's auditors, is a deficit of the considerable amount of 3,464*l.* 17*s.* 8*d.*, which will have to be met out of the Society's general funds, already seriously depleted by the losses on the two previous Shows.

9. The precise amount by which the Society's general funds will be diminished as the result of the working of the present year cannot, of course, be ascertained until after the complete balance-sheet of the calendar year 1900 has been made up and approved by the Auditors. The system of accounts adopted by the Society for some years past was fully dealt with in the Report to the General Meeting held on December 9, 1897, in which it was explained that the Society's accounts are rendered each year in two sections, showing respectively (a) the ordinary income and expenditure on the departments of the Society's public work other than the shows, and (b) the receipts and expenditure at the Country Meetings, the results of both being brought together in a general balance-sheet, showing the financial position of the Society as a whole. It was pointed out in 1897 that whilst all the members of the Society participate in its ordinary privileges, only a proportion of them attend the Shows regularly, and less than 5 per cent. exhibit live stock at the Meetings. For the maintenance of the Society's ordinary operations on their present scale, it was indicated that "the annual subscriptions received from the members who subscribe 1*l.* a year would obviously be insufficient, were it not for a contribution to the revenue of the year from the Reserve Fund, in respect of the share of the expenses due from the Life Governors and Members. This Reserve Fund practically represents the unexhausted balance of the life compositions, and it is now [1897] only preserved intact by the surpluses at recent shows. In the event of a financially unremunerative Country Meeting, it is from the Reserve Fund that the deficit would have to be made good." Hence it is that the unexpected losses from the Show of the present year and those of 1898 and 1899, have caused a shrinkage in the Reserve Fund greater than the reduction through deaths and the effluxion of time of the Society's liabilities to its life members.

10. As is obvious, the takings at the doors for the admission of visitors to the Shows are beyond the power of the Society to forecast, being dependent on the pleasure-seeking proclivities of the public. But the expenditure in the preparations for the Shows is also to a not inconsiderable extent dependent upon considerations over which the Society has no opportunity of effective control. If, for instance, the highly successful York Show of 1883 be compared with the Show of 1900, it is found that whilst, owing to swine fever restrictions, no pigs could be exhibited this year (as against 200 entries in 1883), provision had to be made at the recent Show for 85 more horses, 225 more cattle, and 202 more

pens of sheep than on the previous occasion, for 629 entries of poultry, which were not exhibited at all in 1883, for 403 more entries of produce, and for 1,636 more feet of Implement shedding. This, of course, involved largely increased payments for wages and for timber and other materials—all of which, moreover, are now 25 per cent. dearer than in 1883. There are numerous departments in the Show now which did not exist at all in 1883; and the Society has had of late years to assume the responsibility for various items of expense, from which it was before free. In the administrative departments of the York Show, however, the cost was much the same as in previous years; and if the attendance of paying visitors had been up to expectation, the Show would have been a success from a financial as well as from every other point of view.

11. It is a matter of great regret to the Council that, notwithstanding the excellence of the York Show and the efforts made by all concerned, the attendance of the public—by whose payments for admission the Society had hoped to recoup itself for the immense preliminary expense involved in the preparations—should have been so disappointing: the total visitors numbering only 87,511, which, with the exception of Maidstone, is the lowest recorded since the Reading Meeting of 1882. Many causes, no doubt, contributed to this untoward result; and as the experience of other Agricultural Societies has this year been the same, it is doubtless the fact that the war in South Africa has had a seriously deterrent effect upon the number of visitors at agricultural shows and other exhibitions. But it cannot be overlooked that there is another and more permanent cause affecting the Royal Agricultural Society's Shows from the point of view of attendance of the ordinary sight-seeing and paying public. As was observed in the report dated February 5, 1900, of the Special Committee on the Society's Show system, which was published *in extenso* on pages 65 to 86 of Part I. of the current volume of the Society's Journal:—

The system under which the Society has held its annual Show in a different town each year was inaugurated at a time when one part of England knew very little of the agricultural practices and appliances of other parts, and when an agricultural show of any pretensions was a phenomenon. Out of the "Royal" Shows has sprung a system of agricultural gatherings at which the live stock and other products of different provinces, counties, districts, estates, and parishes compete one against the other; and the modern facilities of railway travelling now place within the reach of almost everyone an agricultural show of adequate dimensions to satisfy the ordinary sight-seeing visitor.

Organisations like the Bath and West, the Royal Counties, the Yorkshire, and the Lancashire Agricultural Societies now hold Shows which approximate in point of size to the "Royal" Shows of a generation ago; and the customary wants of the important districts above mentioned may not improbably be regarded by the residents as sufficiently satisfied by the annual exhibitions in their midst of the Societies referred to. Thus the

**Annual Country Meeting** of this Society has ceased to be the phenomenal attraction it once was in times of less universal travel than at present.

The power of a Show to attract the paying public does not of course increase in proportion to its area and comprehensiveness; and attendances which were once sufficient to leave a surplus are now quite inadequate to meet the augmented expenses of a Show of larger area, increased exhibits, more exact classification, greater comprehensiveness, and much enhanced facilities to exhibitors, members, and visitors.

The expansion in the number and variety of exhibits both of live stock and agricultural machinery has involved a corresponding increase of responsibility and financial risk to the Society, since no more paying visitors come to the Show because it is larger than it used to be, whilst the cost of the preparations for the exhibits and of administration must necessarily increase as the Show grows in size, and as the Society, to meet the demands or needs of the public, undertakes fresh responsibilities.

12. As the members will be aware, this Special Committee reviewed very exhaustively in their report all the considerations which demand attention in connection with the future of the Society's Shows, and finally arrived at the conclusion that "if the Shows are to fulfil their proper function in the future, without an unwarrantable drain upon the Society's general resources, it would be desirable that they should be held upon some permanent location." This conclusion was, as reported to the Anniversary General Meeting in May, endorsed by the Council after deliberate consideration and full debate; and the Special Committee were requested to proceed further in the direction of making inquiries as to possible sites for a permanent Showyard. Many proposals and suggestions have since been received by the Society on this subject, and have been carefully weighed by the Special Committee.

13. From information received by the Committee before they presented their original report of February 5, 1900, it had been regarded as possible that sites might have become available in some of the largest provincial towns on exceptionally favourable terms, either in connection with municipal schemes of development or otherwise; but a more exact study by the Committee of this particular point showed that most of the schemes which were proposed would be dependent for their progress beyond the initial stage upon the Society first deciding for itself whether it would go to the particular town, in which case local assistance was in some instances promised, and in others might be expected towards the acquisition of the site suggested. In these circumstances, and also because difficulties presented themselves in the Society's entertaining any proposition which would not leave it with complete control over the site, the Special Committee sought the instructions of the Council on August 1 as to whether in their judgment the Society's permanent Showyard should be in the neighbourhood of London or the provinces.

14. After a full discussion the Council resolved "that it is desirable to obtain a site in the neighbourhood of London for

the purposes of the Society's permanent Showyard"; and the Committee were asked to continue their labours on this basis. The Special Committee have since been actively engaged in considering various sites offered to them in the London district, and have reported a certain amount of progress in their inquiry, though they are not yet in a position to make any definite recommendation. It appears probable that it will be necessary for the Society to rent, and it may be hoped eventually to acquire, a site of its own, capable of adaptation to the Society's special needs, and of being utilised—during the time it is not required for the preparations for the Show and the Show itself—for any other kindred or subsidiary purposes that may present themselves. The matter is so important for the future well-being of the Society that any proposals for the actual selection and equipment of a permanent Showyard must be thoroughly well considered in all their bearings before a definite decision can be arrived at; and it is not therefore possible on the present occasion to do more than to report progress towards a solution of the difficult problem remitted to the Special Committee for consideration.

15. The Meeting of the Society in the year 1901 will, as already announced, be held at Cardiff: and the Council have decided that the Meeting shall be opened in all departments (Implement, Stock, Poultry and Produce) on Wednesday, June 26. It will remain open on Thursday, June 27; Friday, June 28; Saturday, June 29; and on Monday, July 1.

16. The final date for the receipt of entries in the Implement Department has been fixed for Friday, March 15, 1901, although post entries at double fees may be tendered up to Monday, April 1, 1901. For Live Stock, including Horses, Cattle, Sheep, and Pigs, the entries will close on Monday, April 15, at 10s. per entry; on Wednesday, May 1, at 15s. per post entry; and finally, on Wednesday, May 15, at 17. per late entry. For Poultry and Farm Produce the entries will close on Wednesday, May 1, at 2s. 6d. per entry, and finally on Wednesday, May 15, at 5s. per post entry. Double fees will be payable by Non-Members of the Society. An exhibitor will be permitted to make in the Classes for Live Stock and Poultry as many entries in the Class as there are prizes offered in that class. Provision will be made for enabling exhibitors who have already entered animals to substitute for them entries of other animals in the same class up to Friday, May 31, on payment of a registration fee of 5s. (Non-Members double).

17. The Regulations as to the Exhibition (not for competition) of articles in the Implement Department will be the same in all essentials as in previous years; but as there will not be at Cardiff a preliminary day during which the Implement Yard is alone open, it will be necessary to strictly enforce the regulation under which all exhibits in the Implement Yard sent in by the evening of Saturday, June 22, must be finally arranged, cleared up, and

completed by 5 P.M. on Monday, June 24. The competitive trials of Implements for the Society's Prizes will, as announced to the last Meeting, be of the following classes of Implements :

*Class I.* Portable Oil Engines (power not to exceed 15 B.H.P.). Prizes offered : First Prize, 40*l.* ; Second Prize, 20*l.*

*Class II.* Agricultural Locomotive Oil Engines (power not to exceed 20 B.H.P.). Prizes offered : First Prize, 40*l.* ; Second Prize, 20*l.*

*Class III.* Small Ice-making Plant, suitable for a Dairy (output not to exceed 4 cwt. in 10 hours). Prize offered, 15*l.*

18. The Prize Sheet for Stock, Poultry and Produce has been definitely settled, and will be issued immediately. The Prizes offered in all departments (exclusive of Champion Prizes and Medals offered by various Breed Societies) amount in all to 5,754*l.*, to which the Cardiff Local Committee contribute 712*l.* and various Breed Societies 353*l.* The special prizes offered by the Cardiff Local Committee include four classes for Hunters, four for Hackneys, two for Ponies, two for Welsh Ponies, one for Polo Ponies, four for Harness Horses, two for Colliery Horses, and three for Draught Horses in harness to be exhibited on the Saturday of the Meeting only ; one class for Welsh Sheep, two for Ryeland Sheep, and one for Radnor Sheep. Two classes are also offered for Caerphilly Cheeses of 1901 make.

19. The Classes for Live Stock provided by the Society itself will include Hunters, Cleveland Bays and Coach Horses, Hackneys, Ponies, Mountain and Moorland Ponies, Shires, Clydesdales, and Suffolk Horses.

20. In the classes for Cattle, prizes will be offered by the Society for the Shorthorn, Hereford, Devon, Sussex, Longhorn, Welsh, Red Polled, Aberdeen Angus, Galloway, Highland, Ayrshire, Jersey, Guernsey, Kerry, and Dexter breeds, and for Dairy Cows. The maximum age of Bulls competing for the prizes offered by the Society will be, as a rule, limited to four years, and that of cows to six years, whilst the competition for cows of three years old and upwards will, as announced at the May Meeting, be restricted to animals "in milk."

21. The Classes for Sheep will include Oxford Downs, Shropshires, South Downs, Hampshire Downs, Suffolks, Somerset and Dorset Horned, Lincolns, Leicesters, Cotswolds, Border Leicesters, Kentish or Romney Marsh, Wensleydales, Devon Long-woolled, Dartmoor, Exmoor, Cheviot, Black-faced Mountain, and Herdwicks. The prizes for Pigs will include the Large White, Middle White, Small White, Berkshire, Tamworth, and Large Black breeds.

22. The Council having decided to consider the offer of prizes from Breed Societies direct, in augmentation of those provided by the Society, instead of, as heretofore, receiving such prizes only

through the Local Committee, the offers of the following Societies have been accepted :—The Polo Pony Society, six classes for Polo ponies ; the Shetland Pony Society, two Classes for Shetland ponies ; the Lincolnshire Red Shorthorn Association, four classes for Lincolnshire Red Shorthorn Cattle ; the English Kerry and Dexter Cattle Society, one class for Kerry Heifers and one class for Dexter Heifers ; the Shropshire Sheep Breeders' Association, one class for Shropshire Rams ; the Lincoln Long-wool Sheep Breeders' Association, one class for Lincoln Rams ; the Devon Long-Woolled Sheep Breeders' Society, one class for Devon Long-Woolled Ram Lambs.

23. Prizes will be given by the Society for useful descriptions of Live Poultry (the prizes for dead fowls and ducklings being discontinued) ; for Butter ; for Cheddar, Cheshire, Stilton, Wensleydale, Wilts, Double Gloucester, and other British Cheeses (Cream Cheese excepted) of 1901 make ; and for Cider and Perry. The British Beekeepers' Association will continue their prizes for Hives, Honey, and Bee Appliances.

24. The Horse Shoeing Competition will be continued at Cardiff in two Classes open to the United Kingdom—viz. for Hunters and Cart Horses—and Prizes amounting to 16*l.* will be offered in each class. The Worshipful Company of Farriers have offered to present the Freedom of their Guild, free of cost, to the winner of the First Prize in each Class, provided the Judges consider that sufficient ability has been displayed. The Registration Committee of the Farriers' Company will also admit, free of charge, the First Prize winners in these Competitions to the Official Register of Farriers or Shoeing Smiths, and, on payment of the usual fees, all other competitors who shall duly satisfy the Judges of their efficiency. The Cardiff Local Committee have also offered Prizes for Timbering and Rope-splicing Competitions in the following classes :—Class I. For Timbering (open to Colliers only). Class II. For Timbering (open to Timbermen and Colliers). Class III. For the best Rope Splice in Flattened Stranded Rope.

25. The departments of the Society's public work other than the Show have been maintained in full efficiency during the last half-year and, as stated by the Council in their May report, "it is important for the general well-being of the Society that these departments should be maintained upon their present scale, and that opportunities should not be lost, as they arise, of improving such departments and expanding them in other directions." The possibility of development of the scientific and educational side of the Society's work must, however, be seriously crippled if the funds that could be applied to such purposes should no longer be available in view of the risks of loss on the Shows. Much of the work of the Society has been and is of the nature of pioneer work. It has endeavoured to meet wants which no other organisation existed at the time to deal with, or which the accumulated experience of this Society rendered it the

most competent to undertake. The establishment of a periodical **Journal** of agricultural information ; the analysis of fertilisers and feeding stuffs, and the repression of adulteration ; field and feeding experiments ; the testing of seeds ; the extermination of injurious insects and pests of the farm ; the endowment and encouragement of a better scientific knowledge and treatment of animals of the farm in health and disease ; the institution of Diploma examinations for students of agriculture and dairying—these and other similar efforts for the “general advancement of English Agriculture” the **Society** may claim to have been amongst the first, if not the first, to originate, even if it now shares these functions with newer and more specialised and, in many cases, State-aided organisations.

26. When, however, occasion has arisen for discontinuing or modifying some department of work that it is no longer necessary for the **Society** to undertake on the same scale as before, the **Council** have never hesitated to take steps with this object ; and they are of opinion that the time has now come when the annual expense of the **Society's Journal** may be sensibly reduced. When the **Journal** was originally founded, under the control of Mr. Philip Pusey in 1839, the farmer's opportunities for the acquisition of sound knowledge and teaching as to the management of his land and live stock were infinitesimal as compared with the present day ; and the **Society's Journal** then stood almost alone as the medium for the diffusion of agricultural information. At the present time there are many more channels for saying what there is to be said than in the early days of the **Society** ; and the **Council** are of opinion that it is now no longer necessary for the **Society** to issue a **Quarterly Journal**, with its attendant expense. They have decided, therefore, that after the conclusion of the current volume the **Journal** of the **Society** shall be issued once a year in a volume suitably bound, with the full reports, as before, of the **Council** and the **Society's** scientific advisers, and with articles by expert writers on matters which appear to be of permanent interest and of value for reference. Any reports or memoranda of immediate importance will, however, be communicated as soon as available to the agricultural and general press, and circulated amongst members who may from time to time express a wish to have them. As Dr. William Fream had announced his intention, before this change of practice had been decided upon, of retiring from the editorship of the **Journal** on December 31 next, the **Council** have now under consideration the question of the arrangements to be made for the conduct of the **Journal** in its revised form ; but they take this opportunity to express their high sense of the editorial work done by Dr. Fream for the **Society**, not only in connection with its **Journal**, but also in the compilation of its **Text-book on the Elements of Agriculture**.

27. During the year a total of 660 samples have been sent by members to the Consulting Chemist for analysis, as compared with

802 in the previous year. Notice has been specially directed to the not infrequent occurrence of excessive sand and of useless materials in compound feeding cakes. The Council have also found it desirable to repeat the caution which they before expressed, that purchasers of basic slag should, by submitting samples to analysis, secure that they be supplied with basic slag of guaranteed quality and fineness of grinding. As at this time of the year purchases of basic slag are commonly made, members would do well to be careful to stipulate for a definite guarantee as to percentage of phosphoric acid and degree of fineness of grinding. The recommendation of the Council on this point is as follows :—

**BASIC SLAG** to be guaranteed to be sufficiently finely ground that 80 to 90 per cent. passes through a sieve having 10,000 meshes to the square inch, and to contain a certain percentage of phosphoric acid, or its equivalent in phosphate of lime. (The highest grades range from 17 to 20 per cent. of phosphoric acid; medium grades, 14 to 16 per cent.; and low grades from 10 to 12 per cent. of phosphoric acid.)

28. At the Woburn Experimental Farm the corn crops of the year have been threshed, weighed, and valued, as usual. Experiments on "Finger and Toe" in turnips and on prevention of "Potato Disease" have been continued. The feeding experiments for the winter season 1900-1 have been commenced, that with sheep being upon the early feeding of mangels and the utilisation of gorse as a food; that with bullocks being on the value of condimental foods, *e.g.* sugar, locust-beans, and spice, as additions to an ordinary ration.

29. At the Pot-culture Station at Woburn the experimental crops of the third season have been harvested, and the results are now being collected. A full description of the Pot-culture Station and of the experiments which have been in progress there since its foundation will appear in the next number of the Journal.

30. Experiments on the eradication of certain farm weeds have been also carried out. The most interesting results obtained are those relating to the wild onion and to wild poppy. From these it would appear that if arable land infested with wild onion is sprayed with carbolic acid quite early in the year the wild onion will be killed, but the land itself will not be injured, the carbolic acid being removed from the top soil before a spring corn crop is sown, so that the latter thrives quite well. The spraying of wild poppy on the underside of the leaf with sulphate of copper was largely effective in checking its growth, while spraying on the upper side of the leaf did no good.

31. The majority of the inquiries sent to the Consulting Botanist have related to the purity and germination of seeds. The samples examined showed that the great improvement in the quality of seeds previously noted is being maintained. An increasing number of inquiries have been received dealing with injuries to cultivated plants, the presence of weeds and other injurious plants in pastures,

and the laying-down of land to pasture. An important investigation in the field and in the laboratory has been carried out in relation to a disease in turnips which has seriously injured this crop in several districts. The bulb of the turnip is converted into a fetid pulp through the action of minute bacteria which increase with extraordinary activity. An account, with illustrations, of the malady will appear in the next number of the Journal.

32. The work of the Zoologist's Department has continued with little interruption, some insect attacks persisting unusually late in the autumn. During the whole season certain insects have appeared in remarkable profusion, and as a consequence among the cases dealt with are attacks by insects not usually regarded as serious pests. The common earwig, for example, did considerable damage to turnips and rape in one locality in the middle of July, and the "Silver Y" moth threatened the destruction of a potato crop in the beginning of August. Among parasitic attacks on animals, a case of "leg-scab" on young pheasants was reported.

33. The number of morbid specimens forwarded since the beginning of the year to the Department of Comparative Pathology and Bacteriology established at the Royal Veterinary College by the aid of the annual grant of 500*l.* from the Society has been 355. During the year special experimental investigations have been made, and are still in progress, regarding the immunisation of animals against tuberculosis, the treatment of parasitic gastritis in cattle, and the cause of certain obscure outbreaks of disease in poultry.

34. The experiments with regard to Tuberculin which were begun last year, and the expense of which was defrayed by a special grant of 400*l.* from the Society, have been brought to a close, and the Sub-Committee under whose supervision they were carried out have prepared a report, which will be printed in full in the next number of the Journal. In that report, certain important possibilities of error in connection with the test are pointed out, but the Sub-Committee express the opinion that tuberculin is an agent of great value, far surpassing all other methods of diagnosis, and that, if properly employed, it is calculated to render immense service in dealing with tuberculosis.

35. The facts relating to the occurrence of the contagious diseases of animals during the current year have not been altogether satisfactory. Anthrax has maintained almost the same rate of prevalence as during the preceding two years, but there has been a rather serious recrudescence of glanders. The hopes that were entertained that rabies had been exterminated have not been fulfilled, five cases in dogs and four in other animals having been detected during the second half of the year. The outbreaks of swine fever are nearly 418 less than at the same date last year, but the returns do not hold out much hope that the disease will be exterminated in the near future. Between the last

week of January and the first week of October, 17 outbreaks of foot-and-mouth disease were detected in England and Wales, and 227 animals contracted the disease. The precise source of infection in the first and in most of the subsequent outbreaks could not be ascertained. The last case was detected on October 5, and there is therefore reason to hope that the country is again free from the disease.

36. As the result of the Examination of Students of the Royal Veterinary College in Cattle Pathology, including the diseases of Cattle, Sheep, and Pigs, Mr. Harry Thackeray, M.R.C.V.S., has been awarded the Society's Silver Medal, and Mr. Reginald John Collings, M.R.C.V.S., the Bronze Medal.

37. Following the precedent of previous years, examinations for the National Diploma in Dairying have been held this year for English students at Reading College and the British Dairy Institute, Reading, from September 24 to 27, 1900; and for Scottish students at the Dairy School, Kilmarnock, from October 1 to 3. Nine candidates entered and were examined at Reading, and of these the following six satisfied the Examiners, and have therefore been awarded the National Diploma in the Science and Practice of Dairying :—

ERNEST CHRISTOPHER BROWN, Midland Dairy Institute, Kingstons Fields, Derby.

ELLA EVANS, Tyn-y-Coed, Sarn, Pwllheli, N. Wales.

EDITH MORTON JACKSON, Erw Wen, Llangollen, N. Wales.

MARGARET ROBERTSON McDUFF, British Dairy Institute, Reading.

JOHN PERCIVAL, Harper Fold Farm, Radcliffe, near Manchester.

CHARLES DONALD STEWART, Yarrow Bridge, Duxbury, Chorley.

38. Eight candidates entered and seven were examined at Kilmarnock, and of these the following five were successful :—

JANE BARBOUR, Redwells, Cardenden, Fifeshire.

JOHN DONALD, Burrowin, Bogside, Stirling.

AGNES KINROSS, Wester Balbeggie, Kirkcaldy.

JEMIMA A. VEITCH, Backshot, Forth, Lanarkshire.

PHILIPPA WILKINSON, Needingworth, St. Ives, Hunts.

39. These Dairying Examinations have now been held for five years; and the opinion of those immediately concerned in their

supervision is that the quality of the practical work done, and of the written answers to the papers of questions, has tended to improve, and that fewer candidates than before enter themselves for the examination without preparation or previous study.

40. The National Agricultural Examination Board, the creation of which was reported to the meeting held on December 7, 1899, and on which this Society is represented by six members of Council, with Sir Ernest Clarke as honorary secretary, have recently revised the regulations for the National Diplomas in Agriculture and Dairying. By the courtesy of the authorities of the Yorkshire College at Leeds, the second examination for the Diploma in Agriculture will be held in the great hall of that College on Monday, May 6, 1901, and following days. The entries of candidates for this examination will close on Saturday, March 30, 1901. The examinations of 1901 for the National Diploma in Dairying will be held (for English students) at the Reading College and British Dairy Institute, Reading, from September 23 to 26, and (for Scottish students) at the Kilmarnock Dairy School, Kilmarnock, from September 30 to October 3: the last date for receiving applications being in both cases August 31, 1901.

By order of the Council,

ERNEST CLARKE,

*Secretary.*

13 Hanover Square, London, W.:  
December 12, 1900.

## REPORT OF THE TUBERCULIN COMMITTEE.

SINCE the discovery of the remarkable properties of tuberculin by Koch, the distinguished German bacteriologist, the question of the reliability of the agent as a test for tuberculosis in cattle has been much discussed both in this country and abroad, and very extensive experiments have been carried out in order to provide material from which to form a judgment on the matter. These experiments have generally consisted in testing animals with tuberculin, slaughtering them immediately afterwards, and instituting a post-mortem search for evidence of tuberculous disease. In all cases in which the question has been investigated in this way, and in which the observations have extended to a large series of animals, the results have been fairly uniform. It therefore did not appear to the Committee that it would be advisable to institute an investigation which would merely have been a repetition on a small scale of the numerous and extensive experiments previously made in this country and abroad. They considered that the grant placed at their disposal could be better expended by approaching the subject in another way, and the plan of experiments which they projected was briefly as follows :

1. To select for experiment a number of apparently healthy animals.
2. To test them with tuberculin, and, in the event of their not reacting, to provisionally assume that they were free from tuberculous disease.
3. To experimentally infect such animals with tubercle bacilli—that is to say, to render them tuberculous.
4. To test them at intervals afterwards in order to ascertain how soon, if at all, they would react to tuberculin.
5. To observe the influence of repeated tests, (a) in the way of preventing reaction, (b) as regards effect on the course of the disease.
6. To kill the animals and make a careful post-mortem examination, and to observe whether there were any tuberculous lesions, and if so, whether they were such as could reasonably be attributed to natural infection before the animals were purchased, or were apparently the result of the experimental infection.

It was hoped that by selecting young cattle for experiment only a small proportion would prove to be tuberculous or react to the preliminary test. Unfortunately, however, a considerable number of the animals did react to the first test, and in the case of most of

these the Committee had the unexpected and undesired opportunity of making observations on the old lines, that is to say, by simple post-mortem verification of the accuracy of the reaction.

### FIRST SERIES.

The following six animals were short-horn calves, about nine months old. They were purchased on June 13, 1899, and tested with tuberculin on June 16. Four of them (Nos. 1, 2, 4, and 6) did not react, one (No. 3) reacted distinctly, and one (No. 5) had a doubtful reaction. It was decided to infect Nos. 1 and 2 by injecting tubercle bacilli into the veins, and this was carried out on June 17. The infective material was prepared by pounding the tuberculous spleen of a rabbit with 12 cubic centimetres of water, and allowing the coarser particles to settle to the bottom. Three cubic centimetres of the liquid were then injected into the left jugular vein of each of the two calves selected for experiment.

No. 1.			
		Reaction	Maximum rise
June 16.	Tested with 1½ c.c. of tuberculin	—	·8
" 17.	Infected with tubercle bacilli.		
" 29.	Tested with 1 c.c. tuberculin	+	2·0

After the 29th the animal became very ill, and after July 7 its temperature was always over 105°. As it appeared likely to die soon, it was killed on July 20. The post-mortem examination revealed myriads of tubercles in both lungs and great enlargement of the attached lymphatic glands.

No. 2.			
		Reaction	Maximum rise
June 16.	Tested with 1½ c.c. tuberculin	—	·4
" 17.	Infected with tubercle bacilli.		
" 29.	Tested with 1 c.c. tuberculin	—	·2
July 7.	" " "	+	2
" 15.	" " "	+	2
" 22.	" " "	—	1·2
" 28.	" " "	+	5·8
Aug. 4.	" " " (erratic rise)	?	2·4
" 11.	" " "	—	·8
" 18.	" " "	+	2
" 25.	" " "	—	1·1
Sept. 1.	" " "	+	2·1
" 8.	" " "	?	1·7
" 14.	" " "	+	4
" 16.	" 6 c.c. "	?	1·6
" 24.	" 1 c.c. "	?	1·7

Killed September 25. The post-mortem examination revealed a number of fibrous tubercles towards the bases of the lungs, and some small fleshy tuberculous growths on the pleura. Also a caseous and partly calcified tubercle in one of the mesenteric glands. Tubercle bacilli were proved to be present in both the lung and gland lesions.

These two cases furnish a contrast of which further examples will be found in the later experiments. Although the animals were of the same size and infected simultaneously with the same quantity of material, the course of the disease was very different in them. In No. 1 it would certainly have proved fatal had the animal not been killed 34 days after infection, but in No. 2 the lesions were comparatively slight when it was killed more than three months afterwards.

In No. 1 no lesion except those that were clearly attributable to the intra-venous inoculation on June 17 were found at the post-mortem examination, but the mesenteric tubercle found in No. 2 was probably in existence when the animal was purchased. If that supposition is correct, the tuberculin gave a wrong indication on June 16.

No. 3.				Reaction	Maximum rise
1899					
June 16.	Tested with	1½ c.c. tuberculin	.	+	4.4
" 29.	"	1 c.c.	"	+	4

Killed June 30. One tubercle in a mesenteric gland.

No. 4.				Reaction	Maximum rise
June 16.	Tested with	1½ c.c. tuberculin	.	-	4
" 29.	"	1 c.c.	"	+	3.6
July 7.	"	"	"	-	0
" 15.	"	"	"	-	1

Killed July 20. One tubercle in a mesenteric gland.

The non-reaction on June 16 was in this case a failure of tuberculin.

No. 5.				Reaction	Maximum rise
June 16.	Tested with	1½ c.c. tuberculin	.	P	1.8
" 29.	"	1 c.c.	"	+	3.8
July 7.	"	"	"	+	2.8
" 15.	"	"	"	+	2
" 22.	"	"	"	+	2.2
" 28.	"	"	"	+	3.6
Aug. 4.	"	"	"	P	1.8
" 11.	"	"	"	P	1.8
" 18.	"	"	"	+	2
" 25.	"	"	"	P	1.5
Sept 1.	"	"	"	+	2.5
" 8.	"	"	"	-	.5
" 14.	"	"	"	P	1.2
" 16.	Tested with	6 c.c. tuberculin	.	-	.4
" 24.	"	1 c.c.	"	-	1.4

Killed September 25. Post-mortem revealed no tuberculous disease anywhere.<sup>1</sup>

<sup>1</sup> The post-mortem examination extended to all the common seats of tuberculous disease, including the whole of the respiratory and digestive systems and their associated lymphatic glands.

1899		No. 6.	Reaction	Maximum rise
June 16.	Tested with 1½ c.c. tuberculin	.	—	1.5
" 29.	" 1 c.c. "	.	—	.6
July 7.	" " "	.	—	0
" 15.	" " "	.	—	1

Killed July 20. Post-mortem showed no tuberculous disease anywhere.

### SECOND SERIES.

The following six animals were yearlings purchased for experiment on September 30, 1899. They were submitted to a preliminary test on October 9, with the result that one of them (No. 12) reacted distinctly. It was resolved to try the effect of repeated injections of tuberculin on this animal, and to infect the others by injecting tubercle bacilli into the veins.

The material used to inject into the veins was water with which caseous matter from a tuberculous mesenteric gland of a horse had been rubbed up, and the quantity of this liquid, in cubic centimetres, injected into each of the five animals is noted in the summary given below. Except where otherwise stated the quantity of tuberculin administered was one cubic centimetre. The larger quantities were given in order to observe whether such treatment had any effect on the course of the disease experimentally set up by the injection of tubercle bacilli into the veins.

	No. 7.	Reaction	Rise of temperature
Oct. 9.	Tested	—	1
" 18.	Infected with tubercle bacilli (2 c.c.).		
" 24.	Tested	—	0
" 26.	"	—	0
" 30.	"	—	0
Nov. 2.	"	—	0
" 6.	"	?	1.8
" 10.	"	+	2.5
" 14.	"	+	2.2
" 21.	"	+	3.8
" 28.	"	+	3.3
Dec. 9.	"	—	.6

Killed December 11. Lesions—Miliary tuberculosis of both lungs.

	No. 8.	Reaction	Maximum rise
Oct. 9.	Tested	—	1.3
" 18.	Infected with tubercle bacilli (2 c.c.).		
" 24.	Tested	+	3
" 30.	"	+	2.6
Nov. 2.	"	—	1.5
" 6.	"	—	1.1
" 14.	"	+	2.5
" 21.	"	—	.5
" 28.	"	+	4
Dec. 9.	"	—	0

Between December 22 and January 24, treated with large doses of tuberculin until no reaction even to 20 ordinary doses. Killed February 1, 1900. *Lesions*—Comparatively slight and giving evidence of recovery.

## No. 9.

	1899		Reaction	Maximum rise
Oct.	9.	Tested . . . . .	?	2.1
"	18.	Infected with tubercle bacilli ( $1\frac{1}{2}$ c.c.).		
"	26.	Tested . . . . .	+	4.5
"	30.	" . . . . .	—	.4
Nov.	2.	" . . . . .	—	.4
"	6.	" . . . . .	—	.4
"	10.	" . . . . .	—	.5
"	14.	" . . . . .	—	.4
"	21.	" . . . . .	—	0
"	28.	" . . . . .	—	.3
Dec.	9.	" . . . . .	—	1.2

Between December 22 and January 24, treated like No. 8. Killed February 1. *Lesions*—Only a few fibrous tubercles towards the base of the left lung.

## No. 10.

			Reaction	Maximum rise
Oct.	9.	Tested . . . . .	—	1.3
"	18.	Infected with tubercle bacilli ( $1\frac{1}{2}$ c.c.).		
"	24.	Tested . . . . .	—	.7
"	26.	" . . . . .	—	.7
"	30.	" . . . . .	—	0
Nov.	2.	" . . . . .	—	1.4

Killed December 4. Advanced lesions of acute miliary tuberculosis.

It will be observed that this animal never reacted distinctly, but during the last month it was not tested owing to its temperature being always too high (over  $104^{\circ}$ ).

## No. 11.

			Reaction	Maximum rise
Oct.	9.	Tested . . . . .	—	1.4
"	18.	Infected with tubercle bacilli (1 c.c.).		
"	24.	Tested . . . . .	—	1.2
"	26.	" . . . . .	—	1.4
"	30.	" . . . . .	—	0
Nov.	2.	" . . . . .	+	2
"	6.	" . . . . .	+	2
"	10.	" . . . . .	+	2.3

Killed November 17. *Lesions*—Tubercles both lungs.

<sup>1</sup> This was not regarded as a reaction, because the temperature fell after the ninth hour, and the highest temperature was only one degree higher than on the previous day.

## No. 12.

1899							Reaction	Maximum rise
Oct. 9.	Tested	.	.	.	.	.	+	4.8
" 12.	"	.	.	.	.	.	+	5.1
" 24.	"	.	.	.	.	.	-	.3
" 28.	"	.	.	.	.	.	+	2.6
Nov. 2.	"	.	.	.	.	.	-	1.2
" 10.	"	.	.	.	.	.	+	2.5
" 21.	"	.	.	.	.	.	-	.9
" 28.	"	.	.	.	.	.	-	.6
Dec. 9.	"	.	.	.	.	.	-	.9

In December and January this animal was treated with large doses of tuberculin, and it gradually ceased to react. On February 6 tubercle bacilli (same as used on that date for Nos. 13, 14, 15, and 16) were injected into the jugular vein.

							Reaction	Maximum rise
Feb. 14.	Tested with 1 c.c. tuberculin	.	.	.	.	.	+	2
" 17.	" "	.	.	.	.	.	+	4.2
" 21.	" "	.	.	.	.	.	?	2.1
" 24.	" 5 c.c.	.	.	.	.	.	-	.1
" 28.	" 10 c.c.	.	.	.	.	.	-	.9
Mar. 3.	" "	.	.	.	.	.	-	0
" 8.	" "	.	.	.	.	.	-	0
" 15.	" "	.	.	.	.	.	-	0
" 28.	" 20 c.c.	.	.	.	.	.	-	0

**Killed May 22. Lesions**—One completely calcified tubercle in a mesenteric gland.

This is one of the most interesting animals in the whole series. When first tested on October 9 it reacted very decidedly, and it gave a second decided reaction three days later. Subsequently, it did not react and reacted alternately. For two months it was treated with large quantities of tuberculin (up to 20 doses at one injection), and it entirely ceased to react. It was determined to attempt to re-infect it with the double object of observing whether it would thereby re-acquire the property of reacting to tuberculin, and of seeing whether the combined effect of the previous attack of the disease and the large doses of tuberculin had given it any degree of immunity. Accordingly, on February 6, 2 c.c. of a liquid rich in tubercle bacilli were injected into one of its jugular veins. These bacilli were taken from a tuberculous mesenteric gland, and were proved to be virulent by the result of other experiments (see Nos. 15 and 16). Eight days after the injection of the bacilli, the calf had acquired the property of reacting to tuberculin, and three days later it again reacted decidedly. The animal was again treated with large doses of tuberculin, and always without reaction. It was killed on May 22, and no trace of disease that could be attributed to the injection of bacilli into the veins was found. On the other hand, there was one tubercle of stony

hardness, and obviously quite inert in a mesenteric gland. It is perfectly reasonable to suppose that this mesenteric lesion was in existence and active when the animal was purchased on September 30, 1899, and that the reactions to tuberculin in October were attributable to it. Either from natural causes or in consequence of the repeated injections of tuberculin this tubercle became inactive and practically cured, but the injection of tubercle bacilli into the veins in February last induced a temporary re-infection, during which the animal again reacted to tuberculin. Afterwards it made a complete recovery, proving that it now had a remarkable degree of immunity against tuberculosis. The degree of this immunity may be measured by the fact that the same dose of the same infective material injected on the same day into another subject of about the same size and age produced tuberculous lesions that would certainly have proved fatal had the animal not been killed on April 10 (No. 16).

### THIRD SERIES.

The following six animals were yearlings, purchased for experiments on January 20, 1900, and tested with tuberculin on January 24. In five of them there was no reaction, and in the sixth, the maximum rise of temperature was 1·8, which was regarded as insufficient to condemn the animal. It was resolved to attempt to infect two by injection into the veins, two by injection under the skin of the flank, and two by way of the mouth. In the case of the first two pairs the material injected was liquid holding in suspension tubercle bacilli from a tuberculous mesenteric gland of a horse. Two cubic centimetres of this liquid was used for the intra-venous inoculations, and one cubic centimetre for inoculation into the flanks. For infection of the third pair of animals, a quantity of caseous material from the lungs and lymphatic glands of a cow, about equal in volume to a walnut, was rubbed up in a mortar with a quantity of tap water, and the resulting liquid was equally divided, one half being given to each of the two animals by the mouth. The history of each animal is summarised below :—

#### No. 13.

		Reaction	Maximum rise
1900			
Jan. 24.	Tested with 1 c.c. tuberculin . . .	—	1·5
Feb. 6.	Tubercle bacilli injected into flank.		
" 14.	Tested with 1 c.c. tuberculin . . .	—	1
" 17.	" " " . . .	+	2·5
" 21.	" " " . . .	—	1·3
April 9.	" " " . . .	—	1

Killed April 10. *Lesions*—Tuberculous nodule in flank and tubercles in adjacent precrural gland.

## No. 14.

		Reaction	Maximum rise
1900			
Jan. 24.	Tested with 1 c.c. tuberculin . . .	—	1.3
Feb. 6.	Tubercle bacilli injected into flank.		
" 14.	Tested with 1 c.c. tuberculin . . .	+	2.8
" 17.	" " " . . .	?	1.7
" 21.	" " " . . .	+	3.6
" 24.	Treated with "10 c.c. "tuberculin (initial temperature 104.8). . . .	—	1.4
" 28.	Treated with 10 c.c. tuberculin . . .	+	3.6
Mar. 3.	" " " " . . .	+	2.8
" 8.	" " " " . . .	+	2.8
" 15.	" " " " . . .	+	2.4
" 28.	" 20 c.c. " " . . .	+	2
April 9.	" 1 c.c. " " . . .	?	1.4

Killed April 10. Tuberculous lesions in flank and adjacent precrural gland.

Nos. 13 and 14 were exactly parallel experiments, save that after February 21 the disease was allowed to take its natural course in No. 13, while the effect of large doses of tuberculin was tried on No. 14. In neither animal had the disease spread far from the seat of inoculation, only the adjacent group of lymphatic glands being involved. It could not, however, be said that the post-mortem examination gave any ground for believing that the large doses of tuberculin injected into No. 14 had had a beneficial effect on the course of the disease.

## No. 15.

		Reaction	Maximum rise
Jan. 24.	Tested with 1 c.c. tuberculin . . .	?	1.8
Feb. 6.	Tubercle bacilli injected into jugular vein.		
" 14.	Tested with 1 c.c. tuberculin . . .	+	4
" 17.	" " " " . . .	+	3.4
April 9.	" " " " . . .	?	1.8

Killed April 10. *Lesions*—Miliary tubercles in lungs and liver.

## No. 16.

		Reaction	Maximum rise
Jan. 24.	Tested with 1 c.c. tuberculin . . .	—	1
Feb. 6.	Tubercle bacilli injected into jugular vein.		
" 17.	Tested with 1 c.c. tuberculin . . .	+	2.1
" 21.	" " " " . . .	+	2.8

After March 1 temperature was generally over 104°.

Treated with 10 c.c. of tuberculin on March 3, 8, and 28.

Animal wasted steadily, and appeared much worse than No. 15, which was not treated with large doses.

Killed April 10. *Lesions*—Same as in No. 15, but much more extensive.

Nos. 15 and 16 were also parallel experiments, save that No. 16 received three large doses of tuberculin after it had reacted, in order to observe whether that treatment would have any effect on the progress of the disease. The post-mortem examination showed that the disease was considerably more extensive in this animal than in the one which had only been thrice tested with the ordinary dose. It ought, however, to be stated that No. 16 was much worse than No. 15 before the treatment (as opposed to the testing) with tuberculin was begun, owing probably to different degrees of natural predisposition possessed by the two animals. Since evidence of a curative action of the tuberculin was being sought for, it would obviously have been fallacious to select for the treatment the animal that appeared to be naturally the more resistant of the two.

## No. 17.

		Reaction	Maximum rise
1900			
Jan. 24.	Tested with 1 c.c. tuberculin . . .	—	1.4
Feb. 6.	Fed with tuberculous material.		
" 14.	Tested with 1 c.c. tuberculin . . .	—	.8
" 21.	" " " " " " " " " " " "	—	.6
" 28.	" " " " " " " " " " " "	—	0
Mar. 15.	" " " " " " " " " " " "	—	1.3
Apr. 9.	" " " " " " " " " " " "	—	.9

Killed April 10. No lesions discovered.

## No. 18.

		Reaction	Maximum rise
Jan. 24.	Tested with 1 c.c. tuberculin . . .	—	.1
Feb. 6.	Fed with tuberculous material.		
" 14.	Tested with 1 c.c. tuberculin . . .	+	4.4
" 17.	" " " " " " " " " " " "	+	2.1
" 21.	" " (erratic rise at 6th hour)	?	3.2
" 24.	Treated with 5 c.c. tuberculin . . .	+	5.4
" 28.	" " 10 c.c. " " " " " " " "	+	2.4
Mar. 3.	" " " " " " " " " " " "	+	3.1
" 8.	" " " " " " " " " " " "	+	2.3
" 15.	" " " " " " " " " " " "	?	1.9
" 28.	" " 20 c.c. " " " " " " " "	?	1.3
Apr. 9.	Tested with 1 c.c. " " " " " " " "	—	.8

Killed April 10. *Lesions*—Numerous tubercles in the mucous membrane of the small intestine.

Nos. 17 and 18, as regards the dose of infective material and the method of its administration, were exactly parallel experiments; and they yielded results which are from several points of view very interesting and instructive. No. 17 did not become infected, although it received a quantity of infective material such as it can scarcely ever be the lot of an animal of the bovine species to take into its body at one time, exception being, perhaps, made of calves receiving undiluted milk from a tuberculous udder. That is the first point of interest. The second is that the tuberculin test correctly indicated that the attempt to infect had failed.

The facts relating to No. 18 are no less interesting. Here the attempt to infect succeeded, and the first tuberculin test afterwards, which was made on the eighth day, elicited a most pronounced reaction. It may safely be asserted that had the animal been killed on that day no trace of disease would have been discoverable with the naked eye, and had the date of infection not been known the case would have appeared to be one of failure of the tuberculin test.

It will be observed that for over a month No. 18 was treated with large doses, but although the post-mortem examination indicated that the disease had remained confined to the bowel wall, it might be rash to conclude that it would have spread further had the animal not been treated with tuberculin.

#### FOURTH SERIES.

The following ten animals formed one lot of 18-month-old short-horns purchased for experiment on May 2, 1900. They were all in good condition, and quite healthy looking; but the preliminary test with tuberculin, on May 15, indicated that four of them (Nos. 19 to 22) were already the subjects of tuberculosis. They were killed on May 22, and the post-mortem examination revealed in each of them distinct tuberculous lesions, of considerable standing. The following are the particulars relating to these four animals:—

##### No. 19.

		Reaction	Maximum rise
1900			
May 15.	Tested with 2 c.c. tuberculin . . .	+	3.6
" 21.	" " " . . .	—	.5

Killed May 22. Tuberculous lesions in several mesenteric glands, peritoneum, lungs, and mediastinal glands.

##### No. 20.

		Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin . . .	+	6
" 21.	" " " . . .	+	3.9

Killed May 22. Lesions—Tubercles in two mesenteric glands.

##### No. 21.

		Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin . . .	+	6
" 21.	" " " . . .	—	1

Killed May 22. Lesions—Tubercles in bronchial gland.

##### No. 22.

		Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin . . .	+	3.7
" 21.	" " (somewhat erratic rise)	?	2.8

Killed May 22. Lesions—Tubercles in pharyngeal gland.

In these four cases the post-mortem examination proved the correctness of the indication afforded by the first test with tuberculin. A further point of interest in connection with them is, that the second test, six days after the first, would have acquitted two of them of any suspicion of tuberculosis had it not been known that they had previously been tested.

The following six animals (companions of the preceding four) were purchased on May 2, tested without reaction on May 15, experimentally infected with tuberculous material on May 28, and afterwards tested with an ordinary dose of tuberculin at intervals in order to ascertain how soon each would react. The method of infection was as follows: Pieces of caseous matter from the tuberculous lung and lymphatic gland of a cow, to the volume of a hen's egg, were rubbed up in a mortar with three pints of water, and half a pint of this liquid was administered to each animal by the mouth:—

No. 23.				Reaction	Maximum rise
1900					
May 15.	Tested with 2 c.c. tuberculin	.	.	—	.5
" 28.	Fed with tuberculous material.				
" 31.	Tested with 2 c.c. tuberculin	.	.	—	.4
June 21.	" " "	.	.	+	3.8
July 7.	" " "	.	.	+	4.0
" 18.	" " "	.	.	?	1.4

Killed July 19. Tubercles in pharyngeal and mesenteric glands.

No. 24.				Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin	.	.	—	.5
" 28.	Fed with tuberculous material.				
June 6.	Tested with 2 c.c. tuberculin	.	.	—	.6
" 24.	" " "	.	.	—	.2
July 7.	" " "	.	.	+	4.4
" 18.	" " "	.	.	+	3.8

Killed July 19. Tubercles in three mesenteric glands.

No. 25.				Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin	.	.	—	1.6
" 28.	Fed with tuberculous matter.				
June 10.	Tested with 2 c.c. tuberculin	.	.	—	.4
" 24.	" " "	.	.	—	.4
July 7.	" " "	.	.	—	.4
" 18.	" " "	.	.	+	3.2

Killed July 19. Tubercles in two mesenteric glands.

No. 26.				Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin	.	.	—	1.8
" 28.	Fed with tuberculous matter.				
June 3.	Tested with 2 c.c. tuberculin	.	.	—	.6
" 24.	" " "	.	.	—	1.8
July 7.	" " "	.	.	—	.3
" 18.	" " "	.	.	+	2.6
" 26.	" " "	.	.	+	3.4

Killed July 28. Tubercles in four mesenteric glands.

## No. 27.

1900			Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin	.	—	1
" 28.	Fed with tuberculous matter.	.		
June 13.	Tested with 2 c.c. tuberculin	.	—	1
July 7.	" " "	.	+	2.8
" 18.	" " "	.	+	2

Killed July 12. Tubercles in pharyngeal gland.

## No. 28.

			Reaction	Maximum rise
May 15.	Tested with 2 c.c. tuberculin (erratic rise)	.	?	2.7
" 28.	Fed with tuberculous matter.	.		
June 17.	Tested with 2 c.c. tuberculin	.	—	0
July 7.	" " "	.	+	3.8
" 18.	" " "	.	+	2.7

Killed July 19. Tubercles in pharyngeal gland.

It will be observed that some of these animals, except No. 28, reacted to the first test after purchase. In the case of No. 28, the temperature rose 2°·7, but the course was irregular, and the case had to be considered doubtful. After the administration of the tuberculous material all the animals acquired the power of reacting, but the considerable period that elapsed before a reaction could be obtained is somewhat remarkable. This period was longest in No. 26, which entirely failed to react on the 40th day, but did react on the 51st day, and again on the 59th day. It is impossible in the present state of knowledge to account for this peculiar fact, but it may be pointed out that it certainly was not due to the actual infection—that is to say, the penetration of the bacilli into the tissues—having been delayed, for in all these animals the appearance of the lesions found at the post-mortem examination indicated that they must have been in existence for several weeks, and indeed were in keeping with the view that they had come into existence very soon after the administration of the infective material on May 28. It has for some time been well known that a first reaction in a tuberculous animal may prevent one from obtaining a second decided reaction when the test is repeated soon afterwards, and a good many examples of that are seen in the series of experiments here recorded. It appears to be possible that injections of tuberculin during what may be termed the period of incubation of the disease may have a like effect, although they do not elicit a reaction. If that explanation of the delayed reaction in these cases be rejected, then one would have to admit that in perfectly natural circumstances an animal that had contracted the seeds of the disease might, even with the tuberculin test, pass for healthy for a period of six or seven weeks.

Finally, in connection with this lot of animals, it ought to be mentioned that none of the lesions had an appearance indicating that they must have been in existence when the cattle failed to react to the first test on May 15.

*Analysis of the Results.*

Accepting a steady ascent of the temperature of 2° or more during the twelve or fifteen hours after the injection of tuberculin as a reaction, an analysis shows that six of the animals reacted distinctly to the first test, while seventeen did not react, and five had an uncertain rise of temperature.

In the six animals that reacted the post-mortem examination verified the correctness of the reaction (Nos. 3, 12, 19, 20, 21, and 22). In 15 of the 17 animals in which there was no reaction to the first test, the post-mortem examination disclosed nothing to suggest that the tuberculin had given a wrong indication (Nos. 1, 6, 7, 8, 10, 11, 13, 14, 16, 17, 18, 23, 24, 25, and 27).<sup>1</sup> In one of the remaining animals (No. 2), the tuberculin appears to have given a wrong indication, and in the other (No. 4) it certainly did.

There remain the five animals in which the result of the first test was dubious. The post-mortem examination indicated that four of these had not been tuberculous at the time of the first test (Nos. 9, 15, 26, and 28). The remaining animal was No. 5, which, although it did not react on the first occasion, reacted repeatedly to later tests. Nevertheless, no trace of tuberculosis was discovered in it after death.

If No. 5 be reckoned with the reacting animals, as it is clearly entitled to be, the general result may be stated thus :—

The indication afforded by the tuberculin test appears to have been right in 21 and wrong in 3 (these including one certain error).

Turning, in the next place, to the infections, it will be found that (excluding No. 2, where the tuberculin was apparently in error, and No. 10, in which the temperature became too high to permit of testing) an attempt was made to infect 16 presumably healthy non-reacting animals. The post-mortem examination proved that the attempt was successful in 15 of these, and all, without exception, acquired the property of reacting to tuberculin, but at very various intervals after infection. In the 16th case the animal never acquired this property, and the post-mortem examination indicated that the attempt to infect it had failed.

The following table shows the method of infection and the first date on which a distinct reaction was obtained :—

No.	Method of infection	Day of 1st reaction	No.	Method of infection	Day of 1st reaction
1	intra-venous	12th	14	Into flank	15th
7	"	23rd	18	By feeding	8th
8	"	13th	23	"	24th
9	"	8th	24	"	40th
11	"	15th	25	"	51st
15	"	8th	27	"	40th
16	"	15th	28	"	40th
13	Into flank	8th			

<sup>1</sup> It will be observed that this series of animals includes a large number that were experimentally infected, and in which the post-mortem examination

The facts relating to behaviour with regard to second or later tests with tuberculin are so variable that it is not possible to summarise or tabulate them. The Committee believe that there is a widespread opinion that a tuberculous animal which has reacted distinctly to tuberculin will not react distinctly if the test is repeated after a short interval. If this is a rule, it is subject to numerous exceptions. The important fact, however, remains that in a good many cases a second reaction is not obtainable soon after the first, and by repeated injections an animal may acquire a high degree of tolerance for tuberculin.

It is interesting to recall the fact that, although tuberculin has acquired its reputation mainly in consequence of the assistance which it lends to diagnosis, it was first put forward as a curative agent. Some of the earlier experiments of the Committee (see No. 2) yielded results which suggested that repeated injections of tuberculin retarded the course of the disease; but this view was not supported by the results of some of the later experiments, in which the disease made more rapid progress in an animal treated with tuberculin than in a parallel case left untreated. In reality the experiments have not been sufficiently numerous to justify a positive opinion on the question. It is, however, very obvious from the experiments that, if tuberculin does not influence the course of the disease, the individual resistance to infection varies considerably, and that in some animals it is so high as to enable them to withstand a dose of tubercle bacilli that is rapidly fatal to others of the same size, age, and breed.

#### CONCLUSIONS.

Touching the question of the reliability of tuberculin as a test for tuberculosis in cattle, the Committee believe that the results of their own and other experiments justify the following statements:—

1. With few exceptions manifest tuberculous disease is discoverable at the post-mortem examination of animals in which there is a decided rise of temperature after the injection of tuberculin.
2. As a rule, no such lesions are to be found in those animals in which there is no decided rise of temperature after the injection of tuberculin; but the exceptions to this rule are more numerous than in the preceding case.

Practically speaking, the exceptions under each of these heads may be regarded as failures or errors in the test, but close examination of the circumstances suggests that some of the exceptions may be explained otherwise than by assuming an inconstancy of action on the part of tuberculin.

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did reveal tuberculous lesions, but in most of the cases the whole of the lesions could with certainty be attributed to the experimental infection after purchase, and in the others the situation and appearance of the lesions at least made it highly probable that they also were not in existence when the animal failed to react to the first test.

Taking, in the first place, the apparent failures in the shape of reaction in animals in which no tuberculous disease is discoverable at the post-mortem examination, it is clear that there is room for error in consequence of an accidental rise in temperature during the period of the test. By accidental rise of temperature is here meant an elevation due to any other cause than the tuberculin. The chances of error of this kind may be diminished by making observations on the temperature for some days previous to the intended test, and abstaining from testing any animal in which the temperature has not been normal. In a considerable number of cases such accidental disturbances of the temperature may be recognised by the abrupt rise and fall, but even the curve of a true tuberculin reaction may be simulated by a disturbance of the system from some other cause, and no precautions can entirely eliminate this source of error.

But assuming that a rise of temperature has actually been determined in an animal in which no tuberculous lesions can be found after death, it must be admitted that a small area of disease may escape detection even when the post-mortem examination is of a searching kind. It is, therefore, obvious that even if tuberculin were a perfect diagnostic agent, in the sense that it never produced a reaction in a non-tuberculous animal, it would occasionally appear to be in error. In other words, no test for tuberculosis can be infallible when a rise of temperature is interpreted as evidence of infection, and when failure to discover tuberculous lesions at the post-mortem examination is regarded as proof of freedom from the disease. From a practical point of view the only important question in this connection is—how numerous are the apparent errors? As already stated, they are, according to all published accounts, very few when calculated on a large number of animals tested.

Dealing next with the exceptions to the second rule above stated, it ought to be pointed out that the discovery of tuberculous lesions in animals in which no rise of temperature after the injection of tuberculin has been noted may not in all cases be proof of failure on the part of tuberculin. In the first place, the operator may, in the case of a restless animal, have failed to inject the whole dose of tuberculin under the skin, and, in the second place, he may have made an error in his thermometric observations. Here, again, the practical point is the frequency of the apparent errors of this kind, and the question whether they can reasonably be set down as errors of manipulation or observation on the part of the person conducting the test. It must be admitted that the proportion of such apparent

errors is considerable, and that they cannot be reasonably accounted for on any other supposition than that tuberculin sometimes fails to induce a distinct rise of temperature in an animal that is undoubtedly tuberculous. This defect in tuberculin was very soon brought to light, for in the earlier experiments made with the object of testing its accuracy as a diagnostic agent, the animals selected for the test were naturally those that during life presented distinct signs of tuberculosis, and, indeed, were in many cases in the last stage of the disease. A considerable number of these failed to react, although the post-mortem examination proved that they were tuberculous, and subsequent experience has amply confirmed the correctness of these observations. Moreover, many apparently trustworthy observations indicate that tuberculin sometimes fails to induce a reaction in a tuberculous animal, although the disease is not extensive, or in what would be described as its last stage.

Lastly, tuberculin falls short of infallibility, inasmuch as there is in every case a period after infection during which it provokes no reaction, and some of the experiments described in the preceding pages indicate that this period may be longer than has hitherto been supposed.

Even when full account is taken of these possibilities of error, the Committee are of opinion that tuberculin is an agent of great value, far surpassing all other methods of diagnosis, and that if properly employed, it is calculated to render immense service in dealing with tuberculosis.

(Signed) { BROUGHAM & VAUX.  
NIGEL KINGSCOTE.  
G. T. BROWN.  
J. MCFADYEAN.

October 30, 1900.

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## ANNUAL REPORT FOR 1900 OF THE CONSULTING CHEMIST.

THE Society's Laboratory was concerned during the year 1900 with the examination of 660 samples submitted by members for analysis. The detailed list of samples is given at the end of this Report. The number (660) compares with 802 for the corresponding period of last year.

So far as can be judged from the number of samples sent, there has been an extended use of compound feeding-cakes and meal, while cotton and decorticated cotton cakes have been less employed. No doubt the high prices that have ruled generally for oil-cakes has had a bearing on this, and farmers have probably often been induced to buy a mixed or compound feeding-cake, frequently without inquiry, but simply because of its apparently cheaper price.

A smaller number of samples of manures have been sent this year than last, and it seems remarkable that farmers should be contented to buy expensive manures like nitrate of soda or sulphate of ammonia without asking any questions about them. A good number of samples of basic slag have been analysed, and warning notes issued from time to time by the Chemical Committee of the Society have shown the need of exercising care in the purchase of this fertiliser.

As in previous years, water analyses have formed a very considerable proportion of the total, and there have been rather more soils analysed than usual.

Few, if any, fresh materials have come into use, either as feeding-stuffs or as manures. The popularity of basic slag, probably due largely to its low price, has been maintained.

It is a point worthy of note that, in every instance, during the year, in which I have had to bring instances of adulteration to the notice of the Chemical Committee, this has occurred with feeding-stuffs, and not with manures.

The Board of Agriculture appointed this year a Departmental Committee, of which I was a member, to inquire what regulations might with advantage be made to determine the deficiencies in the normal constituents of milk, cream, &c., which should involve these being no longer considered genuine; a matter of much importance alike to dairy farmers, milk vendors, and the public as consumers.

The Society's Laboratory at Woburn, also under my charge, has been concerned entirely with chemical analyses and investigations arising out of the Field and Feeding Experiments carried on there, the Pot-culture Experiments, and experiments on the eradication of Farm Weeds.

## A. FEEDING STUFFS.

### 1. *Linseed Cake.*

Prices for linseed cake have ruled very high throughout the year, and it is not surprising therefore that many farmers have been led to buy "mixed" cakes instead, at prices 2*l.* and more per ton cheaper. As a rule the samples of linseed cake submitted to me have been good, both as regards quality and purity. A few cases, but not many, of adulteration have been reported. In one instance there was considerable admixture of rape in a cake bought as "best pure linseed-cake"; in another case *Chenopodium* (goose-foot) was the impurity. This latter instance illustrates well a difficulty which has often occurred, and will continue to do so, if purchasers of linseed cake, against the advice given by this Society, are satisfied with having linseed cake described on the invoices as "95 per cent. pure," "made from 95 per cent. pure linseed," &c. The analytical figures can give but a rough idea of the amount of pure linseed originally used, or, what is the same, of the amount of impurity it originally contained. After the seed, with its impurities, has been ground up and the oil in part expressed, it is impossible to calculate back to the original composition of pure seed and impurity. In the case under note the chemist acting for the vendor found equal grounds for his statement that there could at most have been only a little over the allowed 5 per cent. of impurities, as did the analyst for the purchaser, whose opinion was that there was fully 15 per cent. of impurity. I make it a rule to decline definitely to certify to a linseed cake being "95" or any other "per cent. pure." Purchasers must see that they have their cakes invoiced "Linseed cake," without any qualifying terms, or, what is the same, as "Pure linseed cake." All such terms as "oilcake," "95 per cent. pure," "pure as imported," &c., should be avoided.

### 2. *Uncorticated Cotton Cake.*

In my report for 1899 these were spoken of as more satisfactory than before. This has in general been the case this year also, though the seed, and in consequence the cake made from it, has not been so bright and fresh looking. Cases do not, however, now occur so frequently of cakes having excessive cotton wool attaching to the seed, and coarse husk along with it. In two instances proportions respectively of 43.3 and 56 per cent. of coarse husk and wool were found, which are very excessive.

### 3. *Decorticated Cotton Cake.*

In my last report I referred to the marked deterioration of quality which this class of cake has undergone of late years, through excessive hardness, bad decortication, poverty in oil, and careless manufacture. Though this year the cake has not come, I think, so much to the front, and generally has not been used so much, there has certainly been an improvement in the quality of

the samples that have been sent to me ; and I have myself—for the first time for some years—been able to purchase for the Woburn Farm, and for my experiments there, a really soft cake with good percentage of oil, and more like that which used to be upon the market. Analysis of some good samples sent me showed :—

	A per cent.	B per cent.	C per cent.	D per cent.	E per cent.	F per cent.
Moisture . . .	6.98	5.91	6.59	11.08	9.29	8.45
Oil . . .	16.53	14.55	15.41	14.52	15.60	18.52
<sup>1</sup> Albuminous compounds . . .	41.93	43.89	40.08	41.06	40.56	39.75
Gum, digestible fibre, &c. . .	22.50	24.06	24.08	22.24	23.26	23.12
Woody fibre . . .	6.02	5.38	6.46	5.16	4.20	3.36
Mineral matter (ash) . . .	6.04	6.21	6.78	5.99	7.09	6.80
	<hr/> 100.00	<hr/> 100.00	<hr/> 100.00	<hr/> 100.00	<hr/> 100.00	<hr/> 100.00
<sup>1</sup> containing nitrogen	6.71	7.02	6.51	6.57	6.49	6.36

I did not find that these better qualities cost practically more than did the harder and poorer cakes. Nor have I found any sample of decorticated cotton cake to which impurity has purposely been added, but I have had one instance in which a meal sold as decorticated cotton-seed meal was found to have such a high amount of cotton husk in it as to be little better than undecorticated cotton-seed cake ground up into meal ; while in another case a cake sold as "decorticated cotton cake" was so badly decorticated that it gave the following low analysis :—

Moisture . . . . .	10.78
Oil . . . . .	9.50
<sup>1</sup> Albuminous compounds . . . . .	37.87
Gum, digestible fibre, &c. . . . .	25.63
Woody fibre . . . . .	9.20
Mineral matter (ash) . . . . .	7.03
	<hr/> 100.00
<sup>1</sup> containing nitrogen . . . . .	6.06

This cake was found, on mechanical separation, to have 14 per cent. of coarse husk, whereas a first-class decorticated cake would contain only about 1 per cent. The vendors, a Liverpool firm, allowed 1*l*. a ton off the price.

#### 4. *Compound Cakes and Meals.*

I have referred to what is, in my opinion, in many instances the doubtful benefit resulting from the extended use of compound cakes, &c., in place of pure cakes made from some single seed such as linseed, cotton, &c. I am constantly having materials brought to my notice with the suggestion that perhaps they would do in the manufacture of compound cakes. I am sorry to say that it is true of some compound cakes that anything will do for them. The

more careful should a purchaser of compound cakes be, therefore, to go only to firms of high repute who will guarantee the materials they use to be of high quality, good feeding value, and free from weed seeds and useless constituents, and all materials to be in good sound condition.

I have had many instances this past season of compound cakes having excessive amounts of sand. This means, practically, that they are made up from refuse grain, sweepings and the like.

A calf-meal was found to have 2.04 per cent. of sand; a compound cake had 2.70 per cent.; an "oil and treacle cake" 3.99 per cent., and a fattening cake 4.45 per cent. of sand.

#### 5. Wheat Sharps.

A sample was sent me of a purchase under the name "Best sharps made from pure wheat," the cost being 6*l.* per ton. On examination it was found to have a considerable admixture of maize and also rice, while weed-seeds such as *Polygonum* and *Chenopodium* were largely present. The delivery was taken back by the vendor.

#### 6. Pea Meal.

A sample of a delivery of this was found to be much adulterated with maize meal.

#### 7. Niger-seed Cake.

Occasionally this cake comes forward, but the following sample sent me had 4½ per cent. of sand and dirt:—

Moisture . . . . .	12.42
Oil . . . . .	5.62
<sup>1</sup> Albuminous compounds . . . . .	31.61
Starch, digestible fibre, &c. . . . .	22.50
Woody fibre . . . . .	16.77
<sup>2</sup> Mineral matter (ash) . . . . .	11.08
	<hr/> 100.00
<sup>1</sup> containing nitrogen . . . . .	5.06
<sup>2</sup> including sand . . . . .	4.24

The cost was 6*l.* per ton delivered.

#### 8. Gluten Meal.

In my last annual report I gave the analysis of a material called "Gluten refuse," the refuse from starch-making. A different and more valuable feeding material is one obtained from maize and called "Gluten meal." The analysis of a sample sent me was:—

Moisture . . . . .	10.38
Oil . . . . .	2.73
<sup>1</sup> Albuminous compounds . . . . .	35.04
Starch, digestible fibre, &c. . . . .	48.89
Woody fibre . . . . .	2.16
Mineral matter (ash) . . . . .	0.80
	<hr/> 100.00
<sup>1</sup> containing nitrogen . . . . .	5.60

9. *Alfalfa Silage.*

Many have been the attempts to bring over from South America to this country, and to utilise, alfalfa (lucerne) in some form or another. The crumbly nature of the leaf when made into hay is an objection to its use as hay, nothing but the tough stalks being left. It struck someone that, if preserved as silage, the leaf would not be lost, and, if maize were added, a feeding mixture worth bringing over here might be made. A sample of this material was sent to me, and gave the following results on analysis :

Moisture . . . . .	52.08
<sup>1</sup> Albuminous compounds . . . . .	8.06
Starch, digestible fibre, &c. . . . .	26.81
Woody fibre . . . . .	9.47
Mineral matter (ash) . . . . .	3.58
	<hr/>
	100.00

<sup>1</sup> containing nitrogen . . . . . 1.29

This could not, I was informed, be brought over and sold at a lower price than 4*l.* a ton ; but it is difficult to believe that purchasers could be found to pay anything like that price for a material over one half of which is water. The attempt to import silage, from whatever material made, seems absurd ; I was informed, moreover, that the raw material has to have water poured over it before it can be made into silage.

## B. FERTILISERS.

1. *Superphosphate.*

Respecting this widely-used manure there has been very little cause for complaint. Samples sent me have been almost invariably in good condition and up to guaranteed quality.

2. *Dissolved Bones.*

An excellent sample of pure dissolved bones gave the following analysis :—

Moisture . . . . .	9.53
<sup>1</sup> Organic matter, water of combination, &c. . . . .	39.40
Monobasic phosphate of lime . . . . .	6.73
(equal to tribasic phosphate of lime rendered soluble by acid)	(10.54)
Insoluble phosphates . . . . .	24.12
Sulphate of lime, &c. . . . .	18.38
Sand . . . . .	1.84
	<hr/>
	100.00

<sup>1</sup> containing nitrogen . . . . . 8.44

<sup>2</sup> equal to ammonia . . . . . 4.17

This cost only 4*l.* 12*s.* 6*d.* per ton delivered, and was sold as "Pure raw dissolved bones." It was decidedly cheap and well manufactured.

3. *Bone Meal.*

I dealt last year with the question of the preparation of bones by boiling or steaming for a short time only (for the purpose of removing the fat and grease), preparatory to their sale as manure or for dissolving with acid to make "dissolved bones." The following analysis of a sample of English bones which had been steamed for 50 minutes under a pressure of 50 lb. to the square inch may be of interest in this connection :—

Moisture . . . . .	6.62
<sup>1</sup> Organic matter . . . . .	38.36
Phosphate of lime . . . . .	48.23
Carbonate of lime, &c. . . . .	6.55
Sand . . . . .	0.24
	<hr/> 100.00
<sup>1</sup> containing nitrogen . . . . .	4.59
equal to ammonia . . . . .	5.57

It will be noticed that practically none of the nitrogen could have been removed in the treatment.

4. *Peruvian Guano.*

This manure continues, and rightly so, to find favour, and there are still stocks to draw upon. The more phosphatic kinds are frequently very cheap. An instance in point is the following :—

Moisture . . . . .	9.69
<sup>1</sup> Organic matter and ammonia salts . . . . .	10.31
Phosphate of lime . . . . .	62.87
<sup>2</sup> Alkaline salts, &c. . . . .	13.08
Sand . . . . .	4.05
	<hr/> 100.00
<sup>1</sup> containing nitrogen . . . . .	2.04
equal to ammonia . . . . .	2.47
<sup>2</sup> containing phosphoric acid . . . . .	4.36
equal to phosphate of lime . . . . .	9.51
total phosphate of lime . . . . .	72.38

The cost of this, at Liverpool, was only 4*l.* 15*s.* per ton, and the guano must be considered very cheap. As a manure for roots it should do admirably.

5. *Basic Slag.*

The subject of basic slag and the need of care in the purchase of it have been so fully set out in separate reports issued by the Chemical Committee of the Royal Agricultural Society that it is hardly necessary to emphasise these points further. It may, however, be remarked that a higher degree of fineness is obtainable now than formerly, and, as the rapidity of action of the manure depends much upon the fineness of grinding, it is right for the purchaser to insist upon the guaranteed fineness.

6. *Vine Manure.*

Manures sold by nurserymen in small quantities are often put forward at quite unreasonable prices. Such is the manure of which the following is the analysis :—

Moisture . . . . .	13.72
<sup>1</sup> Organic matter and salts of ammonia . . . . .	33.79
Monobasic phosphate of lime . . . . .	8.42
(equal to tribasic phosphate of lime rendered soluble by acid) . . . . .	(13.18)
Insoluble phosphates . . . . .	13.95
Sulphate of lime, &c. . . . .	24.98
Sand . . . . .	5.14
	<hr/>
	100.00
<sup>1</sup> containing nitrogen . . . . .	4.04
equal to ammonia . . . . .	4.91

This manure cost 25s. per cwt., but the real value of it is only about 5l. 10s., or at most 6l. a ton.

The following is the list of analyses made for members of the Society for the twelve months, December 1, 1899, to November 30, 1900 :—

Linseed cakes . . . . .	91
Uncorticated cotton cakes . . . . .	26
Decorticated cotton cakes . . . . .	17
Compound feeding cakes and meals . . . . .	72
Cereals . . . . .	3
Dried grains . . . . .	1
Superphosphates . . . . .	37
Dissolved bones and compound artificial manures . . . . .	20
Raw and degelatinised bones . . . . .	22
Peruvian guanos . . . . .	23
Fish and meat guanos . . . . .	16
Basic slag . . . . .	69
Nitrate of soda . . . . .	9
Sulphate of ammonia . . . . .	6
Potash salts . . . . .	8
Salt . . . . .	1
Shoddy . . . . .	20
Hoofs and horns . . . . .	1
Soot . . . . .	2
Rape dust and manure cakes . . . . .	3
Lime . . . . .	1
Butter, milk, and cream . . . . .	19
Waters . . . . .	141
Soils . . . . .	16
Miscellaneous . . . . .	36
	<hr/>
Total . . . . .	660

J. AUGUSTUS VOELCKER.

13 Hanover Square, W.

## ANNUAL REPORT FOR 1900 OF THE CONSULTING BOTANIST.

DURING the past year 255 inquiries have been answered on behalf of the members of the Society. Of these, 51 dealt with diseases of plants, 10 with plants suspected of causing injury to stock, 32 with weeds, 7 with suitable seeds for laying down temporary or permanent pasture, 2 with the composition of hay, and 153 with the purity and germination of seeds.

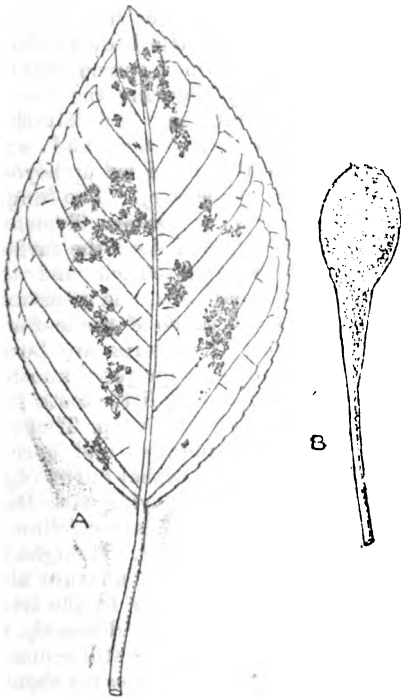


FIG. 1.—*Fusicladium pyrinum*. A, on the leaf of the pear; B, on the young fruit, checking the growth. Natural size.

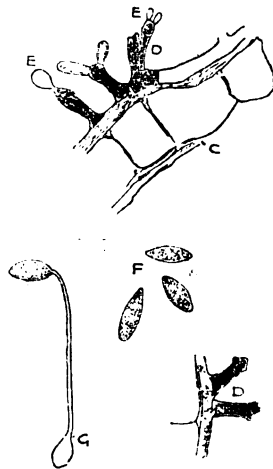


FIG. 2.—*Fusicladium pyrinum*. C, section of the skin of the leaf; D, spore-bearing branches; E, spores in various stages of development; F, mature spores; G, spores germinating. All magnified 330 diameters.

### DISEASES OF PLANTS.

Seven years ago turnips were examined presenting a condition of disease which had not been hitherto observed. But there was not sufficient material to determine the cause of the injury.

A disease of turnips which seriously affected this crop in several districts has been investigated. The results are described in an appendix to this report. The roots of beech trees in Norfolk were

found to be injured by *Agaricus melleus*, a common fungus also found on dead stumps or on the ground. Larch trees from Montgomery were attacked by the small cup-fungus (*Dasyocypha Willkommii*), which was fully described and illustrated in the Journal of 1891, p. 299.

*Fusicladium pyrinum* had attacked the leaves and fruit of pear trees in the beginning of summer. For a considerable time this fungal parasite has been known and combated on the Continent, but has not been noted in this country until this year. The pear trees throughout the country suffered very much last season from the attacks of the pear mite, and on some of the leaves that were

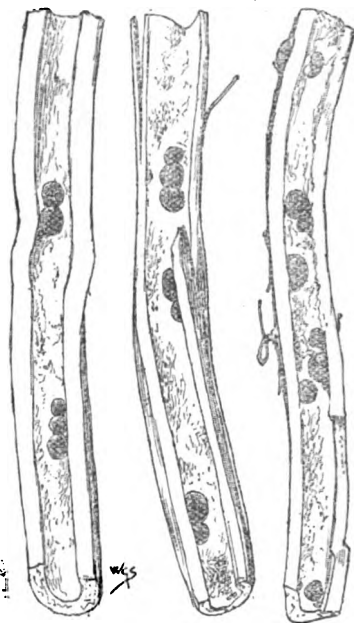


FIG. 3.—*Sclerotinia Sclerotiorum*. Split stalks of beans, showing the sclerotia inside the stem and a sclerotium bursting through the skin. Natural size.

blistered by the galls of the mite this fungus had also appeared in little brown velvety patches, which spread rapidly, seriously injuring the leaves. The fruits had been attacked at an early stage, and were shrivelled and dried up beyond hope of recovery. The fungus consists of brown filaments, which spread along the surface between the cuticle and the epidermal cells, and penetrate into the tissue of the leaf and fruit. The spores are borne on short, upright, knotted branches with little tooth-like projections at the top. They are usually one-celled and germinate as soon as they fall off (figs. 1 and 2). Spraying with Bordeaux mixture has been followed with good results. It might be well to apply the mixture also during the winter to the trees that have been diseased, to destroy any spores still remaining. All diseased leaves should be burned.

*Ascochyta Pisi*, which appeared last year on beans in Sussex, had seriously injured a similar crop in Northamptonshire. *Sclerotinia Sclerotiorum* is a destructive fungus on various cultivated plants. Some years ago it was illustrated and described on the potato in Mr. Worthington Smith's useful volume, *Diseases of Field and Garden Crops*. This year specimens of bean stalks were sent from Sussex by Mr. W. J. Malden, which were found to be attacked by this fungus. The sclerotia were very numerous in the hollow stalks, and some were also found under the epidermis, which, as they grew, burst through and appeared on the outside of the stems.

The presence of the fungus can easily be detected by splitting the stem, when the black sclerotia of various sizes, some nearly as large as a pea, are plainly visible (fig. 3). If left on the ground, the sclerotia germinate in spring, producing small stalked cups which bear the spores that spread the disease. When an attack is discovered, the diseased stalks should be gathered and burned.

A large field of barley was injured by the attack of a fungus similar to the straw-blight described in the Society's Journal in 1872, page 213. Besides the abundant mycelium in the cells then noted and figured, little groups of resting spores were found in the tissue of the leaf at the base of the plant. They are small, almost round bodies, with a thickened outer coat, and appear to be the spores of a species of *Entyloma* (fig. 4). Attempts were made to germinate them, but without success.

Two cases of smut were reported during the year; one was *Ustilago tecta*, or covered smut, the most insidious of the various forms, as it is hidden by the covering of the barley seed, and is consequently garnered with the healthy grains (see Journal for 1896, p. 143). The other was *Ustilago bromivora*, on soft brome-grass. The grass is a worthless weed, and its destruction by fungi or otherwise is not to be regretted. Infection in the case of smut takes place when the host plant is a mere seedling; its growth keeps pace with the plant, and finally it occupies with its spores the seed case of the host; instead of grain, there is only a black mass of spores or smut.

In its effect on the host, smut differs widely from ergot, of which specimens were received during the year. Infection by ergot takes place in the earlier stages of the seed, while the plant is still in flower, and one or more grains may be ergotted while others on the same stalk remain healthy. Smut is, however, non-poisonous, and ergot is hurtful. The most efficient remedy for smut is the use of scalding water, as described in the special report on *Smut in Barley* in the Journal for 1896, p. 146.

Specimens of badly withered barley were received from Hertfordshire, which were found to be attacked by two kinds of fungi. One of these, *Oidium monilioides*, is a white mould, a stage of the mildew, *Erysiphe graminis*. The Erysiphes are destructive parasites on leaves, such as vine-mildew, hop-mildew, &c. These moulds spread over the epidermis and completely arrest the living function of the leaves. As they are surface moulds, they can be destroyed by spraying when taken in time.

The other fungus is *Helminthosporium gramineum*, which was observed in 1898 in barley from Lincolnshire. Having reappeared

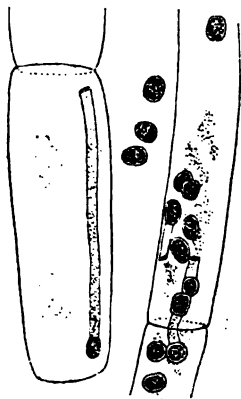


FIG. 4.—Straw-blight. Resting spores of the fungus in the cells of the leaf of barley. Magnified 360 diameters.

this year, it seems desirable to give some further details, with a figure of the fungus (fig. 5). It spreads through the cells of the host and produces brown, irregularly shaped, upright branches, on the tips of which are borne the large brown spores, which soon mature and germinate, thus spreading the disease. This fungus is easily detected by the withered aspect of the leaves, and, on closer examination, by the long yellow streaks edged with the brown fungus. It weakens the plant by using up the food material and destroying the functions of the leaf.

*Ecidium grossulariae* has been again reported. It is unfortunately a common parasite on the gooseberry, but the injury done

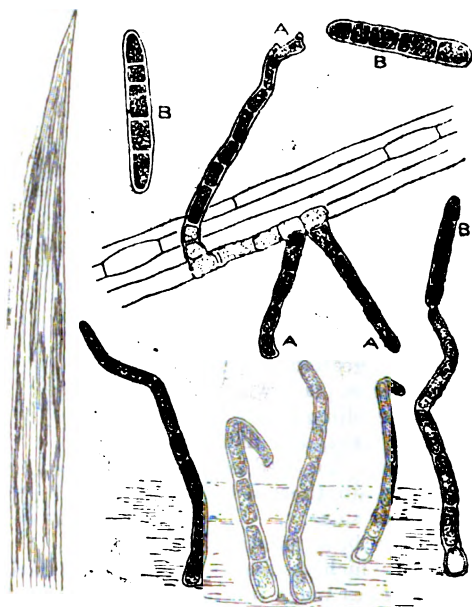


FIG. 5.—*Helminthosporium gramineum*. Tip of barley leaf attacked by the fungus (slightly reduced). A, spore-bearing branches; B, spores. Both magnified 260 diameters.

is never very serious. Its recurrence might be prevented by collecting and burning the diseased leaves and fruits.

Some tulips were received from Herefordshire that had been destroyed by *Botrytis parasitica*. This fungus is a stage of a cup-fungus (*Peziza*), and in the *Botrytis* form it causes great damage to the plants attacked; it produces branches tipped with clusters of spores, and as a resting stage it forms little black hardened masses of mycelium (sclerotia), which are dormant during the winter, and in spring produce the *Peziza* stage. The sclerotia of the tulip disease have hitherto been described as growing on the bulbs, but in the specimen examined they appeared in great numbers on the

leaves. They are still under observation and may be induced to germinate at the proper season. From the same county were sent some leaves of the violet that were attacked by the fungus *Ovularia lactea*, a leaf parasite. The mycelium burrows in the tissue of the leaf and produces on the surface little, erect, delicate branches that bear the colourless spores. The part of the leaf attacked is left quite white with a brownish edge, and through the growth of the fungus the spot gradually enlarges. The spores were produced on the under side of the leaf. This fungus weakens the plant by destroying the tissue of the leaves.

Some broccoli that had failed owing to what was called in Warwickshire "blindness" were sent for examination, and the leaves were found to be suffering from *Peronospora Brassicae*, which is nearly allied to the potato disease. The leaves were being destroyed by this fungus, but, in addition, the flowers of the broccoli were attacked by bacteria. It would be interesting to determine if these were the same bacteria that have been so destructive in the turnip-field. This could only be decided by infection from the broccoli to the turnip, or *vice versa*, which may be done in another season.

#### INJURIES TO STOCK.

Inquiries were made in regard to plants suspected of being poisonous. Most of these plants have been figured and described in recent reports, and do not need to be again referred to. A member found some ergot last year in certain pastures in Bedford. This year a mare slipped her foal on one of these pastures, and it was believed to be due to the presence of ergot. The dose given by a doctor is from twenty to forty grains. I found that eight of the largest ergots I had in my possession weighed a grain. This means that an ordinary dose would require from 160 to 480 ergots. In the case of so large an animal as a mare three or four times that quantity would be required to produce similar results. I have never found, after the most careful search in ergotted pastures, more than twenty ergots, and the great majority of them much smaller than the eight that weighed a grain. It appears to me improbable therefore that ergot can be an active agent in producing abortion on stock feeding in pastures where it is known to be present.

A sample of oats used for feeding horses and believed to be injurious was found to contain only one per cent. of other seeds, one-third of which were those of Bindweed, the other two-thirds were seeds of Corncockle; *Lathyrus sativa* and ergot were found in small quantities. As I have repeatedly pointed out, the Corncockle and *Lathyrus* possess injurious properties, but the quantity was so small that they could scarcely have caused injury to the horses.

#### WEEDS.

*Genista tinctoria* (Dyer's green-weed), fig. 6, is too frequently neglected and allowed to run over pastures. It is a perennial plant,

with a widely creeping root, which gives off short branching stems. The stems are free from prickles, and have narrow oval leaves of a shining green colour. In July and August the branches bear at their tips numerous crowded yellow flowers, which are followed by pods, each containing several seeds. These plants are usually avoided by stock. It is said that when they are eaten the bitter disagreeable taste of the plant is to be detected in the milk and butter. It ought to be got rid of as at best a worthless weed. Its creeping roots cannot be eradicated unless they are dug out. If the plant is abundant it would be advisable to break up the pasture, cultivate it well for two or three years with root crops, and then lay it down with good and suitable seed.



FIG. 6.—Dyer's Green-weed (*Genista tinctoria*, Linn.).

*Anthriscus sylvestris* (Beaked Parsley), fig. 7. A common plant in woods and hedgebanks, sometimes spreading into fields. It has a tapering root, a furrowed stem, hairy and purplish at the base, and numerous clusters of white flowers. Cases are recorded of this weed being injurious to stock, but this rarely happens, as it is universally avoided. It is none the less an undesirable plant in a meadow; but, being a perennial, the tap-root should be removed in order to eradicate it thoroughly; in any case, it should not be allowed to spread from seed.



FIG. 7.—Beaked Parsley (*Anthriscus sylvestris*, Hoffm.).



FIG. 8.—Fleabane (*Pulicaria dysenterica*, Cass.).

*Pulicaria dysenterica* (Fleabane), fig. 8. Found in shady places, by the sides of ditches and streams. It is a perennial plant, with

many stems, thickly covered with soft woolly leaves, and heads of bright yellow flowers. The medicinal properties which in former days it was believed to possess were imaginary, and the plant is no longer used. It is usually confined to the margins of the fields, where it increases by its branching roots; it should be prevented from spreading into the field, though it would be better to get rid of it altogether.

*Plantago media* (Lesser Plantain), fig. 9. A common weed in lawns and pastures. It is a perennial plant, with a thickish woody root. It may easily be distinguished from the larger plantain by its smaller spike of flowers, which are lavender-coloured when in bloom, and by the leaves being without a stalk. This weed cannot be got rid of unless its perennial root is spudded out.

*Rhinanthus Crista-Galli* (Yellow Rattle), fig. 10. A common



FIG. 9.—Lesser Plantain (*Plantago media*, Linn.).

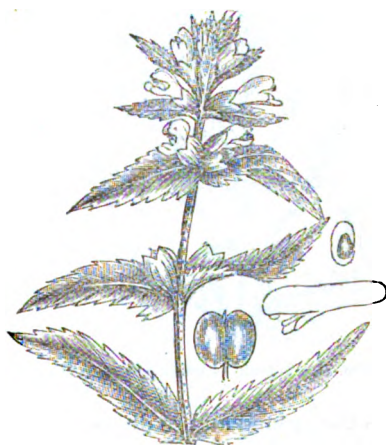


FIG. 10.—Yellow Rattle (*Rhinanthus Crista-Galli*, Linn.).

weed in damp meadows and pastures. It is an annual plant, which can easily be got rid of if it is prevented from seeding. The flowers, which are yellow, spotted with violet, appear from May to July, and the heads should be cut off when the flowers are fully out. The English name has been given to the plant because the seeds when ripe become loose and rattle in the hard seed-vessel. The plant is a root parasite, getting part of its nourishment by stealing it from the roots of neighbouring plants.

*Verbena officinalis* (Vervain), fig. 11. A perennial plant found usually by road-sides, but reported from Hampshire as having spread into pasture to an injurious extent. The spikes of flowers are not conspicuous, as the lilac petals push themselves only a little way out from the calyx. The small seeds are frequently found in clover-seed. The plants should be prevented from seeding, but the whole plant may be removed by pulling when the soil is soft with rain.

*Allium vineale* (Crow Garlic), fig. 12. Though not so offensive as Ramsons or Garlic (*A. ursinum*), this smaller plant is not desirable in any pasture. The whole plant is pervaded with a garlic taste and odour, which is communicated to the milk and its products. The slender stem springs from a small ovate bulb. The leaves are round, hollow, and tapering. The flower-head is largely (sometimes completely) replaced by bulbils, which, when ripe, fall to the ground and reproduce the plant. The few flowers are raised on slender stalks above the crowded bulbils, and are small, of a green or pink colour. It is desirable to prevent the bulbils or seeds from falling



FIG. 11.—Vervain (*Verbena officinalis*, Linn.). FIG. 12.—Crow Garlic (*Allium vineale*, Linn.).

to the ground and so disseminating the pest. To clear it out of a field where it is abundant it would be necessary to break up the field with a somewhat deep plough, and cultivate it, so as to clean the ground.

WILLIAM CARRUTHERS.

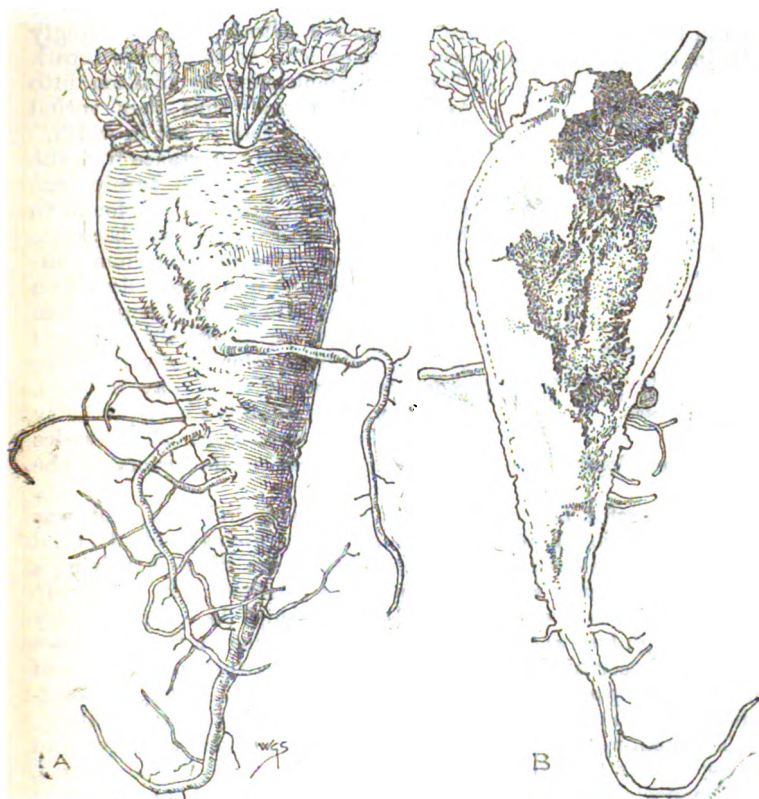
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## APPENDIX.

*On a Disease in Turnips caused by Bacteria* : by W. Carruthers, F.R.S., and A. Lorrain Smith.

At the beginning of August 1900, a number of badly diseased swede turnips were sent from the Valley of the Nibb, in Yorkshire, in order that the nature and cause of the injury might be determined. In the worst cases the young leaves had disappeared from the crown or were rotting away; the outer older leaves also

showed signs of wilting, their stalks were decaying at the base, and a number of lateral buds were shooting up from the axils of these older leaves. As a rule, the outer skin of the turnip was intact. In some instances, the top was as if scooped out, and the depression lined by a whitish slimy substance. In others injury had further penetrated to the base of the turnip, and the whole centre was a mass of



**FIG. 1.—Turnip attacked by bacteria.** A, external aspect, showing the crown killed and new growth from the axils of the first leaves, which had naturally fallen off; B, section of the same turnip, showing the crown of the turnip destroyed, the hollow cavity produced by the first stage of the disease, and the further injury by the bacteria in the centre of the turnip. Both half natural size.

rotten pulp. Even in the plants less seriously affected, it was evident from the condition of the younger leaves that they were being cut off from their connection with the root. Some of the turnips had wounds at the side or base which formed starting-points of attack in addition to the injury at the top of the bulb. One or two were suffering from Finger and Toe, which was of course quite distinct from the rottenness that was destroying the turnips.

A careful microscopic examination of leaf and bulb was made, and it was found that the injury was due to bacteria, which had gained access to the living plants between the bases of the young leaves or through the broken surface of the bulb. They were advancing into the substance of the turnip from cell to cell, destroying the tissues as they went. Sections were taken from the diseased parts and examined, and myriads of the bacteria were seen in the cells. They were motile, cylindrical rods, exceedingly minute, the longest about seven times as long as they were broad.

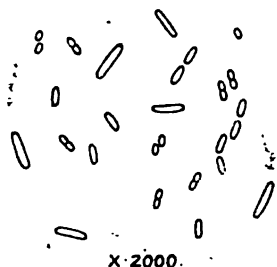


FIG. 2.—Bacteria which cause the disease in the turnip. Magnified 2,000 diameters.

These rods multiplied by division into two and four, and thus they varied greatly in length, though not in width.

Some of the slimy substance from the cavity at the top of the turnip was stained and examined, and was found to be crowded with the same bacteria. Cultures were tried in a medium consisting of gelatine and turnip decoction by introducing into it the bacteria taken from different parts of the diseased swedes, and little colonies of very active rods were formed in a day or two.

Unfortunately, there was no opportunity at the time of infecting healthy swedes from these colonies, and of following the entire life history of the bacteria.

As a careful field examination seemed desirable, a visit was made to the injured crops in Yorkshire. The disease had advanced very rapidly; fields of swedes that appeared healthy and thriving a fortnight previously were now completely blighted; not one turnip in five seemed to have escaped. Yellow turnips had suffered very little, though here and there a few plants growing on the head rows of the fields containing the diseased swedes were attacked; some of the cabbages planted near were also diseased, but a strip of kohlrabi right through the centre of a diseased crop was quite healthy.

The kohlrabi appears so far to be immune, and cabbages and yellow turnips safe when not in the neighbourhood of the disease. The mangels growing in the same field were not in the least attacked. Generally the bacteria had entered at the bases of the leaves of the central bud, and, where circumstances favoured their development, had increased rapidly, until the whole interior of the plant from the crown downwards was destroyed.

The disease worked great havoc in Yorkshire, and the same injury was reported from two localities at a distance from each other in Dumfriesshire. At a later period the disease was largely arrested; the destruction of so many leaves and roots had left the rows somewhat bare. Sunlight and air gained free access to the bulbs, and the bacteria were dried up or destroyed.

Many investigators in recent years have experimented on the influence of sunlight on bacteria, and have proved that in most cases

they grow only in darkness In 1877 and 1878 Downes and Blunt found that, while their growth was retarded by the influence of diffused white daylight, it was completely stopped by sunshine. Another observer found that the destruction of germs was more rapid and complete when there was also a free admittance of air, though one of the most recent workers in this field, Professor Marshall Ward, has shown that the sun's rays alone are sufficient to kill them. He confirmed this by exposing to the light of the sun plate cultures of the spores of the anthrax bacteria covered over with pieces of cardboard, out of which figures and letters had been cut, thus allowing the direct influence of the sun to act on well-defined areas. The spores were rendered inactive on the exposed patches, the gelatine remaining clear, while the darkened parts underneath the cardboard were opaque with the crowded colonies of bacteria that had developed from the spores.

The same influence appears to have been equally powerful in the turnip-field, for in many cases the only trace of injury left was a clean walled cavity at the top of the turnip, from which no information could be gathered as to its origin. It is very doubtful if any true reparation of the injury followed the growth of the lateral buds. These young growths could not arrest the progress of the bacteria, much less repair the injury that had been done.

Nothing can be done for the bulbs attacked, but something should certainly be done to prevent a repetition of the epidemic in the coming season. The myriads of bacteria in the injured turnips should be destroyed. This would effectually be done by building the diseased turnips into a heap in layers, placing between each layer a plentiful supply of quicklime, and covering the whole with earth. When the turnip is too far gone to be pulled, it should be dug up. This heap, after remaining for two years, would, mixed with earth, make a good top dressing for pastures. There would be nothing in the pasture which the spores would attack, if any survived the severe treatment they had received in the pit. It would be dangerous to grow a crop of swedes, or indeed of any allied plants, such as cabbage, kohl-rabi, yellow turnip, &c., on the land for some years following. The bacteria would in time die out for lack of nutriment.

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## ANNUAL REPORT FOR 1900 OF THE ZOOLOGIST.

### INTRODUCTION.

THE department has again had to deal with applications covering a considerable range, the number of different creatures inquired about exceeding fifty. The year has been remarkable for the profusion in which certain insects have appeared, but, on the other hand, some pests which have shown signs of increasing of late, such as the "pear midge," do not seem to have been quite so much in evidence.

All the ordinary corn pests have been the subjects of complaint, and it has been thought well to deal with them briefly in this report in a manner convenient for reference.

Several inquiries have related to diseases of fowls and domestic animals, and these have been dealt with where pathological research was not involved.

### I. PARASITIC DISEASES OF ANIMALS.

#### LEG-SCAB IN FOWLS.

An application was received in April for advice with regard to a disease on the legs of young pheasants reared by hens. It proved to be a case of Acariasis, called "scabies of the legs," due to the presence of a microscopic mite known scientifically as *Scabies mutans* (fig. 1).

The disease is recognised by the appearance of greyish scabs or incrustations on the upper part of the toes and on the tarsus, or part immediately above them. These frequently break and bleed, and are evidently the seat of much discomfort to the fowls, which frequently peck at them. Lameness often ensues, and sometimes the irritation gives rise to more deep-seated troubles, which result in the entire loss of some of the toes.

The mite which causes these scabs is a minute creature which creeps underneath the scales and sets up an irritation which results in the exudation of purulent matter and an abnormal growth of the epidermic cells surrounding it. If the scab is detached, its white under-surface is seen to be honeycombed by minute cavities, each containing one of the mites. The creatures do not burrow tunnels, as is the habit of the itch-mite, but remain in one spot when they have once attached themselves. The great majority of them are observed to be females distended with eggs.

This is a contagious disease, the mites passing from fowl to fowl when cooped up too closely and not allowed sufficient exercise. The commoner breeds of fowls are less subject to it than the rarer varieties.

*Treatment.*—It is clearly desirable that fowls entrusted with the rearing of pheasants should be carefully selected free from this disease. The pheasants would probably be much more likely to receive the contagion than the chickens of the hen herself.

In the poultry yard infested fowls should be isolated, and the sound birds allowed plenty of exercise. The perches and beams which have been used by the diseased birds should be washed with dilute carbolic acid or with boiling water.

To cure the disease Neumann<sup>1</sup> recommends the following method:—

Steep the legs in tepid water for a few minutes, and remove the scabs with a small brush. When dry, apply a coating of "Hemerich's Pomade" or of "Balsam of Peru." If the latter, the dressing must be renewed daily for two or three days.

#### TAPE-WORM IN DOGS.

Among the applications relating to animal parasites examples of small straw-coloured objects which were found in the coats of dogs, and which had greatly puzzled their owners, were sent for identification. They were shrivelled and in bad condition, but it seemed likely that they were tape-worm segments, and the examination of microscopic preparations of the specimens proved this to be the correct view. They were taken for the most part from young dogs which slept in baskets, a condition of things favourable to the presence of the segments where they were found, for it is known that the terminal segments of the tape-worm are constantly separating themselves and leaving the rectum, and that they have the power of slowly crawling about. In endeavouring to escape they would climb on the basket and thence often reach the dog's back. Their presence there was doubtless entirely accidental, as, in order for their life-cycle to be completed, it is necessary for the eggs which they contain to be devoured by some other animal, the second "host" differing according to the particular species of the tape-worm.



FIG. 1.—A, Leg of a fowl infested with "leg-scab"; B, Female of *Sarcophaga mutans*, greatly magnified. (After Neumann.)

<sup>1</sup> "Parasites of Domestic Animals."

## OTHER ANIMAL PARASITES.

There have been the usual complaints of the warble-fly and of the sheep nostril-fly. The latter pest never appears to be recognised until the maggots are leaving the sheep's nostrils and the attack is practically over. In districts where sheep are known to be attacked by this fly pastures bordered by underwood should be avoided as far as possible, and smearing the sheep's muzzles with fish oil during the hot weather is advisable. A short account of this pest appeared in the Report of the Zoologist for 1893.

There is often an ambiguity in the questions relating to insects attacking stock from the loose use of the popular term "gad-fly." The gad-flies are, strictly speaking, the biting flies (*Tabanidæ*), which irritate by their bite but do no further harm. The "bot-flies" (*Estridæ*) do not bite, but lay eggs on their victims and spend their lives as grubs in some portion of them. The maggots in the horse's stomach, in the sheep's nostrils, and in the "warbles" in the hides of cattle are the young of various "bot-flies."

The interest which has been excited in mosquitoes on account of their proved connection with malaria has led to specimens of gnats being sent for identification with a question as to whether or not they were mosquitoes. The mosquito, however, is of no particular species, and the name is applied to any biting gnat, or fly of the family *Culicidæ*. Our commonest English gnat, *Culex pipiens*, is one of the most troublesome mosquitoes in India, though it is not a serious pest in this country.

## II. INSECTS ATTACKING CROPS.

## CORN CROP PESTS.

Advice has been asked during the year with regard to most of the insects which attack corn crops in this country, and it may be convenient to give a brief recapitulation of the life-histories of these pests which attack barley, wheat, and oats. Such universal root-feeders as wire-worm and crane-fly grub ("leather jacket") are omitted. The following key to the various attacks may be found useful:—

**Barley**—Crop failing in June or July. Whitish maggots or flaxseed-like puparia under sheathing leaves near a knot, above which the stalk often bends down . . . . . *Hessian fly*.

Ears "gouty" or swollen, and unable to emerge from the spirally twisted sheathing leaves. Track eaten along one side of stem from the uppermost knot into the ear. Usually noticed in June, but can be detected earlier . . . . . *Gout-fly*.

Some ears white while most are still more or less green. Largeish grub or chrysalis in the very bottom of the stalk . . . *Corn sawfly*.

Crop failing when very young. Very small white maggots in the stem near the roots . . . . . *Frit-fly*.

**Oats**—Sickly appearance of plant, with slightly swollen and twisted roots. No maggots visible to the naked eye.

Probably *Stem eelworm*.

Failure of very young crop. Minute white maggots in the stem just above the roots . . . . . *Frit-fly*.

Wheat—Failure of young crop in April or May, with discoloration just above the root, where whitish maggots may be found . . . . . *Wheat-bulb fly*.

Up-standing white stalks among the green bowing sound stems. Large maggot or chrysalis in the very bottom of the injured stalk . . . . . *Corn sawfly*.

Swelling above first or second joint from the ground. Whitish maggots or flaxseed-like puparia inside sheathing leaves. Injured stalks often bend over . . . . . *Hessian fly*.

Small orange-coloured maggots feeding on the grain in the young ear . . . . . *Wheat midge*.

### 1. HESSIAN-FLY. (*Cecidomyia destructor*.)

Most English farmers are now familiar with this insect, and the fears which its advent in 1886 very naturally occasioned have, to a large extent, subsided. Happily, this climate has not proved favourable to its development, and, moreover, we entirely escape the autumn attack, which is even more disastrous than that of the spring brood in those countries where the autumn crops are sown at a much earlier date than in England.

*Life-history*.—The brown gnat-like fly is about the eighth of an inch in length, with long legs and antennæ. The two wings are smoky or clouded, and fringed with hairs. It appears in May, and lays its minute yellowish eggs near one of the knots of the stalk—usually the second from the ground. In four days the whitish grubs hatch out and fix themselves under the sheathing leaves, sucking the sap from the stem. When fully grown their outer skin hardens and turns dark brown, and they become puparia. It is these puparia (fig. 2) which are popularly termed “flaxseeds.” The flies emerge from some of these puparia in September, and in this country either perish or attack wild grasses. In America and South Europe they attack the autumn-sown corn.

Many of the puparia last over the winter, giving rise to flies the following May.

*Plants infested*.—Barley, wheat, rye, timothy, and couch grass.

*Treatment*.—The following measures tend to prevent the recurrence of attack :—

1. The destruction of “flaxseeds” found on threshing.
2. The burning or deep ploughing-in of the stubble.
3. The treatment of infested straw by close stacking or some other method to prevent the fly emerging.

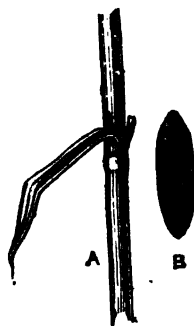


FIG. 2.—A, Corn-stalk with “flaxseed” in position; B, “Flaxseed” magnified.

4. The suppression of couch or timothy grass, as far as possible, in the neighbourhood.
5. The avoidance in adjoining fields of crops liable to attack (wheat, barley, rye).
6. The choice of strong-strawed varieties of such crops when next sown.

## 2. GOUT-FLY. (*Chlorops tæniopus*.)

This insect, which occurs especially in barley crops, is the cause of considerable annual loss.

*Life-history*.—This is a prettily-marked two-winged fly, one eighth of an inch in length, straw-coloured, with black marks on the head and thorax.

The eggs are laid in May, within the sheathing leaves, near the top of the young plant, and the yellowish maggot furrows the stalk within and below the forming ear, causing it to shrivel, and often to remain enclosed within the sheathing leaves, which become spirally twisted at the top and present a "gouty" appearance (fig. 3). In July the maggots change to brown puparia, out of which the flies appear in August.

*Treatment*.—If the attack is noticed early, its bad effects may be much diminished by the application of some quickly-acting, forcing manure, such as nitrate of soda. As the grubs attack the uppermost part of the stem, most of the puparia are carried off in harvesting the crop. Some, however, are shaken out and remain in the stubble. These puparia should be destroyed, as far as possible, before the flies emerge.

In the second place it is always observed that late-sown barley suffers most, for if the insect appears when the plant is young the whole crop may be destroyed. The following measures are therefore recommended :—

1. Scarify or cultivate the stubble immediately after harvest.
2. Destroy the chaff and "cavings" if found to contain puparia.
3. Use infested barley-straw at once for litter, or else stack it compactly so as to prevent the escape of the fly.
4. Sow early.
5. Keep down self-sown corn, and avoid rye or winter barley near infested fields.

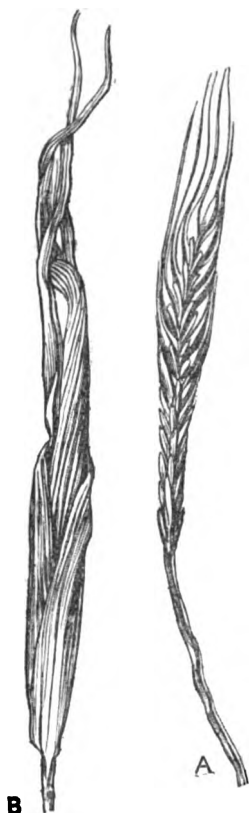


FIG. 3.—Barley attacked by GOUT-FLY. B shows the gouty ear; A, the channel cut by the grub along the stalk and into the ear.

3. FRIT-FLY. (*Oscinis frit.*)

*Life-history.*—The very small, glossy black fly, about one-twelfth of an inch in length, may be seen "dancing" about the oat plants at the end of April or the beginning of May. The minute reddish eggs hatch into grubs which eat into the heart of the young plant just above the root. If the central shoot with the young ear is established, it sickens and readily comes away from the root. The maggots feed in the bulb during May, and turn to chrysalids in June. The flies come out in about ten days, and lay their eggs on grasses. There is a third brood, which also lays on grasses or on winter-corn crops, and it is the chrysalids of this brood which survive the winter and give rise to the spring attack.

Oats alone suffer in England, but barley, wheat, and rye are attacked on the Continent.

*Treatment.*—1. The application of some quickly-acting manure, especially if there is a prospect of rain. 2. On the Continent oats usually suffer when winter rye has been grown in the neighbourhood. It is desirable, therefore, to keep these crops as separate as possible. 3. In cases of bad attack, plough in at once, and destroy the brood. 4. Sow as early as possible. 5. Foreign oats purchased for sowing should be examined for the "puparia" or chrysalids.

4. WHEAT-BULB FLY. (*Hylemyia coarctata.*)

*Life-history.*—This insect is grey in colour, and nearly the size of the common house-fly. It lays its eggs in March near the roots of the wheat plants.

The maggots eat into the heart of the plant, where they feed throughout April, attaining nearly the third of an inch in length.

In May they leave the wheat and burrow into the ground to turn to chrysalids. Little is known of its after-history, but it probably has subsequent broods on wild grasses, and thus in its habits closely resembles the much smaller "frit-fly."

*Treatment.*—Wheat after fallow suffers most, though the reason for this is not known.

No satisfactory preventive measures have been discovered, but thick seeding is recommended where attack is anticipated.

5. WHEAT MIDGE. (*Cecidomyia tritici.*)

The orange-coloured maggots found feeding in the wheat ears during June and July are the grubs of this small yellow midge or gnat-like fly. The midges themselves may often be seen swarming about the wheat on June evenings.

*Life-history.*—The female midge lays her eggs during June and the early part of July in the ears of the wheat, several eggs being deposited in the same ear.

The maggots feed on the grain for about three weeks, and then leave the ear to go down to the ground to pupate (or turn to chrysalids).

The true pupa or chrysalis is not formed till the following spring, but the grub spends the winter a few inches below the surface of the ground enclosed in a transparent case.

At harvest-time many of the maggots are not yet ready to descend, and are carried off with the crop. Thus after a severe attack both the harvested wheat and the remaining stubble require attention.

*Treatment.*—The measures indicated are:—1. Some treatment of the chaff and cavings which shall effectually destroy the grubs. 2. Deep ploughing of the stubble after attack.

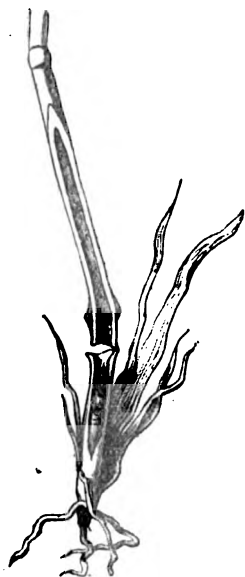


FIG. 4.—Wheat-stalk cut open to show injury done by CORN SAWFLY. The chrysalis is seen in the bottom of the stalk, which is cut transversely above it.

#### 6. CORN SAWFLY. (*Cephus pygmaeus*.)

*Life-history.*—This insect does not belong, like the foregoing, to the Diptera or true flies, but to the Hymenoptera, the order which includes the bees and wasps.

It is unlike most sawflies in being long and narrow, about one-third of an inch in length. It is black, with some yellow spots and bands, and with four transparent wings.

Sawflies are so called because the females possess a remarkable apparatus in the form of a double saw, and with this the female of the corn sawfly cuts a hole near the bottom of the stalk of wheat or barley in June, and in this hole she places the egg.

Most sawfly grubs have many legs, but in that of the corn sawfly they are rudimentary, and the creature is nearly legless.

It feeds on the pith of the lower part of the stem, and grows to a length of about half an inch. Then it goes down to the very bottom of the stalk, which it bites through in such a way that it easily breaks off, as if cut clean about an inch from the ground. In the short length of straw below the cut the grub surrounds itself with a silken cocoon and turns to a chrysalis (fig. 4).

If undisturbed it remains in this retreat till the following May, when a sawfly emerges from the cocoon.

It is clear, therefore, that the pest entirely remains in the stubble, and none of the chrysalids or grubs are carried off in harvesting the crop.

*Treatment.*—Immediately after harvest take measures to destroy the stubble, by burning if practicable.

7. STEM EELWORM. (*Tylenchus devastatrix*.)

If a young oat crop fails, and the presence of no insect pest can be detected, it is probable that it is suffering from the disease sometimes called "tulip root." The plant becomes rank and sickly, and the bottom of the stem generally swells somewhat, while the bases of the leaves round the main shoot become gnarled and twisted.

The cause of the disease is not an insect, but a microscopic worm, which is present in myriads in the diseased stems. If an injured part is squeezed into a drop of water on a slide and examined with a moderate microscope, the small wriggling "eelworms" will be readily seen. Clover crops also suffer from this pest, which is one cause of "clover sickness."

*Treatment*.—1. Dress affected crop with sulphate of potash.

2. Avoid clover after tulip-rooted oats.<sup>1</sup>

3. Beware of using farmyard manure obtained from animals which have been feeding on eelworm-infested crops. The pest is frequently conveyed to clean land in such manure.

4. Deep cultivation, by burying deeply the infested stems of the stubble, diminishes future danger.

## III. ROOT PESTS.

The great abundance of certain insect forms by which the past year was characterised was indicated by two quite unusual attacks which are worth recording.

The first was an attack on turnips and rape by earwigs—not the "lesser earwig," which has on a few previous occasions been accused of similar depredations—but the common large earwig (*Forficula auricularia*). The attack took place in July, and it was ascertained beyond doubt that the earwigs, and not any other less obvious pest, were destroying the crops in a serious manner. This seemed to be a new departure for an insect which, though a recognised nuisance to the gardener from its habit of destroying the petals of flowers, is not regarded as a formidable agricultural pest.

The measures suggested for coping with the attack were:—

1. The reduction of shelter for the insects by hedge-clipping, etc.  
2. Trapping the earwigs by laying down old matting or cabbage-leaves.  
3. The introduction, if practicable, of chickens or ducklings into the field. The second unwonted attack was by the grubs of the "Silver Y" moth (*Plusia gamma*) on a potato crop at the end of July.

This caterpillar is a general feeder, and almost any garden plant is to its taste, but its forces are seldom marshalled in sufficient strength to make it formidable.

The attack did not last very long, and a timely downfall of rain

<sup>1</sup> It often occurs that clover has been put in with oats which develop "tulip-root." In such cases the clover is almost certain to become "stem-sick," and it is better to anticipate this, feed it off bare in the autumn and treat it as stubble, a catch-crop of rape being taken on the land after thorough scarifying.

remedied a good deal of the harm which was done. On August 2 I was informed that a "black and white spider" was helping to clear off the pest, but my efforts to obtain specimens were unsuccessful, and I unfortunately have no clue to the identity of this friend in need. These two attacks must be regarded as the result of a large temporary increase, which favourable circumstances brought about, in insects uniformly present in moderate numbers, and the probability is that next year they will revert to their normal condition.

The "death's-head" moth has been again plentiful in the past year, and specimens of its caterpillar have been sent frequently from potato crops, but more out of curiosity, aroused by its great size, than from fear of the depredations of a serious pest.

Wire-worms, surface-caterpillars and millipedes have also been complained of among root crops, but not to an unusual extent. A beetle identified as *Gastrophysa polygoni* was accused of injuring mangels in one case, but the real culprits proved to be surface-caterpillars.

#### MISCELLANEOUS PESTS.

Farmers are sometimes alarmed by the occurrence of myriads of minute black leaping insects which occur in pools of water in stock-yards, and send specimens of them for identification. They are *Podura aquatica*, of the order Aptera, and are of importance as indicating that the water in which they occur is foul and unfit for cattle to drink from, though the insects themselves are entirely harmless. They feed upon decaying matter in the surface scum, and pure water is therefore of no use to them. It is advisable to clear away any infested puddles to which cattle have access.

Again during the past year the grub of the pea-weevil (*Sitona lineatus*) was observed to be injuring the roots of pea-plants. The weevil itself has long been known to injure peas and clover by nibbling the leaves, but for a considerable time the habits of the grub were unknown, and only of late years has it been complained of. The failure of the crop due to this cause is noticed in March and April, but if the attack is slight the application of a stimulating manure sets matters right. If, however, the crop is ruined, it is advisable to treat the ground at once so as to prevent the grubs completing their life-cycle and coming out as weevils.

Among fruit pests the "codlin" moth has been especially troublesome, and there was a good deal of aphid or blight. The shrivelling of pear leaves in one case proved to be due to a less common pest, the gall-mite (*Phytoptus piri*), a creature allied to the too well-known blackcurrant gall-mite.

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## Notes, Communications, and Reviews.

### THE AUTUMN OF 1900.

THE weather of last autumn was marked by few features of any striking importance. Frosts were rare, and seldom of any great severity, snow was almost entirely absent, and the gales experienced were few in number, and, as a rule, of only moderate strength. In the western and northern districts rain was frequent, but, with one notable exception, the individual falls were of no great weight, the autumn presenting in this respect a marked contrast with the corresponding season of many recent years.

September was upon the whole an extremely fine month, with plenty of sunshine, and a great absence of rain, especially in the eastern and southern districts. In the middle of the month temperature rose to a summer level, but at most other times the air was pleasantly cool, and for the belated holiday-maker the general conditions were as favourable as could possibly have been desired.

October was far less settled, but in the eastern and southern districts there was, in spite of occasional rains, a good deal of fair weather. Stiff gales from the south-westward prevailed between the 4th and 6th, and slight gales at various other times during the month, the weather being under the almost constant influence of cyclonic disturbances moving outside our western and northern coasts. The most important feature was occasioned, on the 26th, by the formation of a small secondary depression over the north of England which was accompanied by a tremendous fall of rain in the counties of Durham and Northumberland. In many places the amount collected during the twenty-four hours ending with the morning of the 27th was considerably over three inches, the sudden downpour resulting in serious floods, with considerable destruction of property and some little loss of life. As the disturbance passed away over the North Sea the wind increased greatly, and on the night of the 26th a severe gale from west and north-west blew for a short time over the north-eastern parts of the country.

In November the weather was mostly changeable, with a good deal of cloud and mist, but with a general absence of the thick fogs with which the month is so commonly associated. Very few gales

were experienced, and those reported were as a rule slight for the time of year, the principal case occurring between the 16th and 18th, when a rather prolonged storm from the north-eastward blew on our east and south-east coasts. Sharp frosts occurred at various times during the middle portion of the month, but these, like most other events of the season, were of no unusual severity for so advanced a period in the year.

The leading features in the weather of the entire autumn are shown in a statistical form on p. 759, the following remarks giving further details of interest in the history of each particular element.

*Temperature.*—The mean temperature was above the average in no fewer than ten of the thirteen weeks included in our report, the three exceptions occurring respectively in the first week of September and the third weeks both of October and November. The greatest excess of warmth occurred at the end of October, the mean temperature for the week ending November 3 being in many places at least seven degrees above the normal. With so large a prevalence of mild weather the temperature of the whole season was naturally above the average, the excess being small in the western districts, but rather large in most other parts of the country. As a rule the undue warmth was almost as conspicuous at night as in the daytime. In the north-eastern counties, however, and also in the Channel Islands, the excess of heat shown by the night readings was comparatively small, while in the south-western district the mean of all the night temperatures agreed very closely with the average.

Over the country generally the autumn was slightly cooler than in 1899, and much cooler than in 1898. In the western and southern districts it was also cooler than in 1897, but in all parts of the country it was much warmer than in 1896, the latter being the coldest autumn experienced over England since 1887. The highest temperatures of last autumn occurred about the middle of September, mostly between the 13th and the 16th, when the thermometer in the shade rose to 75° and upwards in all but the north-eastern counties, and to slightly above 80° in some portions of our eastern and south-eastern districts. Another spell of warmth occurred during the second week in October (chiefly on or about the 8th), when the thermometer rose to 70° and upwards in all but the western districts, and to 75° at several places in the east and south-east. Throughout the season the heat was at no time so great as in the autumn of 1898 or 1899, or as in that of 1895; it was, however, greater than in 1894, 1896, and 1897. In our eastern, midland, and southern counties the maximum autumn temperatures in the three years last mentioned were about 20° lower than those recorded in 1898. The lowest temperatures of last autumn were observed as a rule during the middle portion of November, the actual date of the occurrence varying greatly in different parts of the country. Between the 11th and 13th and between the 20th and 22nd sharp touches of frost were experienced in many places, the lowest readings reported in the screen being 23° at Swarraton (in Hampshire, near

**Temperature, Rainfall, and Bright Sunshine experienced over England and Wales during the Thirteen Weeks ended Dec. 1, 1900.**

(The Autumn Season.)

Districts	TEMPERATURE							
	Highest observed	Lowest observed	Day temperatures		Night temperatures		Day and night temperatures combined	
			Mean	Difference from average	Mean	Difference from average	Mean	Difference from average
North-eastern counties . . .	71	28	55.5	+1.8	43.6	+0.5	49.6	+1.2
Eastern counties . . .	82	24	57.9	+1.9	44.3	+1.7	51.1	+1.8
Midland „ . . .	75	25	56.6	+1.2	42.5	+0.9	49.6	+1.1
Southern „ . . .	82	23	58.6	+1.5	45.6	+1.1	52.1	+1.3
North-western counties, including North Wales .	77	24	55.3	+0.6	44.8	+0.4	50.1	+0.5
South-western counties, including South Wales .	78	25	57.7	+1.4	45.1	-0.1	51.4	+0.6
Channel Islands . . .	77	36	60.3	+2.3	50.7	+0.8	55.5	+1.5

Districts	RAINFALL				BRIGHT SUNSHINE			
	Days with rain		Total fall		Duration		Percentage of possible amount	
	Number	Difference from average	Amount	Proportion of average amount	Hours recorded	Difference from average	Percentage	Difference from average percentage
North-eastern counties . . .	53	+1	ins.	per cent.	255	-8	27	-1
Eastern counties . . .	48	-3	4.8	61	357	+29	38	+3
Midland „ . . .	49	-1	6.2	74	302	+31	32	+3
Southern „ . . .	44	-5	6.3	67	388	+49	41	+6
North-western counties, including North Wales .	57	+3	11.0	96	314	+50	33	+5
South-western counties, including South Wales .	57	+1	11.3	86	386	+55	40	+5
Channel Islands . . .	56	-5	8.7	76	425	+33	44	+3

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office. The averages employed are : For Temperature, the records made during the twenty-five years, 1871-95 ; for Rainy Days, the values for the fifteen years, 1881-95 ; for Total Rainfall, those for the thirty years, 1868-95 ; and for Bright Sunshine, those for the fifteen years, 1881-95.

Alresford), and 24° at Hillington (Norfolk) and Newton Reigny (near Penrith). At many places in the west and north a rather sharp frost was experienced about the middle of October (between the 14th and 16th), when the sheltered thermometer fell to 25° at Llandovery (Carmarthenshire), to 26° at Newton Reigny, and to 28° at Durham. The autumn frosts differed little in intensity from those of the three preceding years. They were, however, less sharp than those recorded in 1895 and 1896, the thermometer in each of these years falling below 20° in several parts of the country.

*Rainfall.*—September proved a very dry month, the rainfall over a considerable portion of England being less than one-fourth of the average. At Loughborough there had not been so dry a September since the register commenced in 1872; while at Liverpool, Clifton, and Cirencester the deficiency of rain was greater than in any September back at least as far as 1866. In the east and south October was also dry, but in the west and north there was an excess of rain, the wettest times occurring at the beginning and the end of the month. During the earlier half of November the rainfall was slightly in excess of the average, but in the latter half there was in most places a deficiency in the amount.

Taken as a whole, the season proved a dry one in all but the north-eastern districts, where, owing mainly, if not exclusively, to the very heavy fall of October 26–27, the total amount of rain was slightly in excess of the average. In the north-western counties the deficiency was not great, but in other districts it was considerable, the aggregate amount in the south being little more than two-thirds, and in the eastern counties less than two-thirds of the normal. In the north-eastern district and also in the Channel Islands the autumn was the wettest since that of 1896. In the north-west, however, the season of 1899 was equally wet, and in the south-west the amount of rain was as large as in 1898. In the midland and southern counties the autumn was drier than in the two preceding years but not so dry as in 1897, the difference being very marked in the south. In the eastern district it was the driest autumn for at least seven years past, and at some stations—such, for example, as Yarmouth—for at least thirty years past. The number of days with rain was slightly more than the average in the west and north, but less in all the eastern and southern districts. Over the country generally rain was more frequent than in any of the three preceding autumns, the excess in this respect being quite as large in the drier as in the wetter districts. Throughout the season individual falls of any great weight were rare. By far the most important case occurred during the twenty-four hours ending October 27, when the counties of Durham and Northumberland were visited, as has already been stated, by a downpour of exceptional severity, the rain being preceded in some places by considerable falls of snow or sleet. More than two inches fell in many parts of the counties named, while in an area of about fifteen miles in breadth and of about thirty miles in length, extending from Morpeth to Durham, the amount reached or exceeded three inches.

The heaviest falls recorded were 3·7 inches at Alnwick Castle and at three or four places in the neighbourhood of Morpeth, Sunderland, and Newcastle-on-Tyne ; 3·4 inches at Chilton Moor, and 3·3 inches at Seaham. The only other times in which daily falls of an inch or more occurred over anything like a large district were on October 4 and 5 and on October 29. On one or other of the former dates 1·3 inch fell at Skipton and 1·2 inch at Arlington (North Devon) and Haverfordwest ; on the latter date 2·1 inches fell at Arlington, and 1·0 inch at Dungeness.

For the twelve months ending with November the rainfall was in excess of the average in the more western and northern parts of the country, the excess being small in the south-west but large in the north-east. In the Channel Islands the amount agreed almost precisely with the average, but over our eastern, southern, and midland counties there was a deficiency, slight in the central, but rather large in the eastern and southern districts. The wettest time of the whole twelve months occurred in the winter, when the total rainfall was everywhere greatly in excess of the normal. The driest weather occurred as a rule in the spring time, but in the eastern counties the deficiency of rain was greatest in the autumn.

*Bright Sunshine.*—In September and October the duration of bright sunshine was mostly in excess of the average, the only week with anything like a general deficiency being the third in September. The finest weather of the whole autumn occurred just a week earlier, when more than 60 per cent. of the possible amount was recorded in many places, and more than 70 per cent. at several coast stations in the west and south. In November the weather was as a rule cloudy and misty, the deficiency of sunshine being especially large in the earlier part of the month. Taken as a whole the autumn was a fairly sunny one, the total duration being in excess of the average in all but the north-eastern counties, where there was a slight deficiency. Over the eastern parts of the country generally the season was not so fine as that of last year, but in the midland and southern counties the amount of sunshine agreed very closely with that experienced in each of the two preceding autumns, and was with these two exceptions larger than anything recorded since 1895. In both the western districts (the north-western and the south-western) there was more sunshine last autumn than in any of the six preceding years.

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## RECENT AGRICULTURAL INVENTIONS.

*The subjects of Applications for Patents from September 5 to December 8, 1900.*

N.B.—Where the invention is a communication from abroad, the name of the inventor is shown in *italics*, between parentheses, after the name of the applicant.

### Agricultural Machinery and Implements, &c.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
15788	RIDLINGTON, W. .	. Potato digging and picking machine.
15934	HUNTER, J. H. C. .	. Attaching mould boards to ploughs.
15972	TIEDEMANN, P. .	. Potato diggers.
16099	MCDONALD, J. .	. Planting cabbages.
16477	PARISH, E. W., & anr.	. Steaming chaff, hay, &c.
16512	HARRIS, G. .	. Potato raiser.
16887	SLADEN, F. .	. Lawn mowers.
17114	ANKETELL, J. .	. Machine for planting potatoes.
17345	PARMITER, P. J. .	. Flat hoeing single turnips.
17686	RANSOME, J. E. .	. Machine for turning grass swathes.
17793	NEIL, W. J. .	. Chaff-cutting machines.
18013	COFFINBERRY, C. C.	. Ploughshares.
18015	ASMORE, A., & anr.	. Combined plough and fertiliser distributor.
18369	BOARDMAN, J. .	. Raising potatoes.
18404	COCKS, J. R. .	. Dropping and covering potatoes by horse power.
18588	BROWN, W. D. .	. Self-binding reaping machines.
18672	GLOVER, W. .	. One-horse potato digger.
18722	HOLE, J. .	. Automatic sack filling and weighing machine.
19158	LALOR, W. M. .	. Apparatus for heading cocks of hay.
19207	LOWSON, J. .	. Ploughs.
19285	MOTLEY, J. .	. Threshing machines.
19628	SYMES, S. J. .	. Corn and grass cutting machines.
19764	BURGESS, C. T. .	. Mowing machines.
19796	SELLAR, R. H. .	. Ploughs.
20141	LISTER, W. Y. .	. Mowing, reaping, and harvesting machines.
20170	ARBEE-MATHEE, J.	. Cultivators.
20416	MCGREGOR, A. .	. Mowing and reaping machines.
20550	FOXTON, W. .	. Harvesters.
20551	" " .	. Cutting, tying, and delivering green clover.
20555	SIMON, R. .	. Cleaning grain.
20790	SCHÄFER, W. .	. Feed apparatus for threshing machines.
20806	BILLIQUOD, F. A. .	. Decorticating machines.
21187	WYATT, R. J. .	. Chaff-cutting and root-pulping machinery.
21246	FOWLER, R. H., & anr.	. Ploughs.
21277	LARKIN, J. .	. Potato diggers.
21369	BRYERS, R., & anr.	. Potato diggers, &c.
21751	SHUTTLEWORTH, A., & anr.	. Threshing machines.
21963	RUSTON, F. T., & anr.	. Ploughshare.
22031	GALE, F., & anr. .	. Sowing, manuring, harrowing, &c., in combination with ploughs.
22187	HUSSEY, R. W. .	. Mowing machine.
22221	JOHNSTON, W. F. .	. Mowers.

### Dairy Utensils, &c.

15983	ROBERTS, S. L. .	. Cream separator.
16199	MORRIS, E. W. .	. Diabetic sugar-free milk.

No. of Application. Year 1900.	Name of Applicant.	Title of Invention.
16711	STORER, D. . . . .	Preservation of milk in transit.
17116	WORTMAN, W. H., & anr.	Barrel churns.
17223	SHARP, T. W. . . . .	Butter and butter substitutes.
17256	MARKS, G. C. . . . .	Churns.
17360	BARNES, W., & anr.	Milk-cans.
17384	HADDAN, H. J. ( <i>The Aktiebolaget Separator Co., Sweden</i> ).	Removing and replacing plates of centrifugal separators.
18052	WATTS, R. J. . . . .	Portable creamery.
18057	GRUNENBERG, J. . . . .	Churns.
18473	WHITING, A. E. . . . .	Leg rope attachment for securing milking cows.
19341	WEDDEL, W., & anr.	Treating separated cream.
19347	WILLIAMS, H. C. . . . .	Churns.
20190	CLARKE, T. T. . . . .	Cheese cutters.
20370	KINGSBURY, G. J. . . . .	Appliance for dividing butter into pats.
20685	LLOYD, F. J., THORP, W., & anr. . . . .	Treating milk, &c.
20766	CAMPBELL, J. . . . .	Cheese press.
20859	BERGHMARK, C. S. . . . .	Centrifugal cream separator.
21193	HEINRICHS, O. . . . .	Churn.
21305	ISCOVESCO, H. . . . .	Treatment of butter.
21626	NEISSE, J. H., & anr.	Margarine.
22198	CALDWELL, R. . . . .	Probe instrument for facilitating milking.
22331	MAGGS, R. . . . .	Steam separator.

### Poultry and Game, &c., Appliances.

15787	FRIEDMANN, H. L. . . . .	Case for conveying eggs.
16489	GILMOUR, W. . . . .	Egg tester.
16649	GREENWOOD, W. W. . . . .	Incubators.
16966	CALWAY, W. . . . .	Movable poultry-houses.
17409	" " . . . . .	Poultry or game coops.
20096	HELLIWELL, T. A. . . . .	Apparatus for rearing chickens.
20182	TAMLIN, W. . . . .	Lamps of incubators.
21093	GREEN, M. . . . .	Testing and conveying eggs.
21763	KERFOOT, J. T. . . . .	Incubators.
21766	MILNE, J. . . . .	Appliance for use in "sieving" milk.
22064	FLEMING, W. . . . .	Tray for turning eggs.

### Miscellaneous.

16017	GREEN, W. J. . . . .	Perforated manger trough.
16099	MCDONALD, J. . . . .	Planting cabbages.
17537	ROXBURGH, J. J. . . . .	Sheep wash.
19913	SMALLWOOD, A. . . . .	Hurdles.
21261	BRIGGS, J., & anr.	Apparatus for cleaning cattle.

**Numbers of Specifications relating to the above subjects published since September 8, 1900.<sup>1</sup>**

(Price 8d. each copy.)

Specifications of 1899.

19749, 20356, 20381, 20653, 20685, 20707, 21574, 21591, 21671, 22010, 22160, 23835, 24382, 24704, 24798, 24855, 25037, 25264, 25329, 25728.

Specifications of 1900.

468, 568, 1011, 1484, 1541, 4357, 4780, 5202, 5614, 6287, 6917, 7215, 7771, 9204, 10107, 10997, 11622, 11626, 13074, 14112, 14210, 14580, 14833, 14861, 14883, 14898, 15160, 16158, 17256, 18288, 18473, 18964.

<sup>1</sup> Copies may be obtained at the Patent Office (Sale and Store Branch), Quality Court, Chancery Lane, London, E.C.

# STATISTICS AFFECTING BRITISH AGRICULTURAL INTERESTS.

**TABLE I.—Acreage under Crops and Grass, as returned upon June 4, 1900, and June 5, 1899, in Great Britain, with Totals for the United Kingdom.**

		GREAT BRITAIN		UNITED KINGDOM, including ISLE OF MAN and CHANNEL ISLANDS	
		1900	1899	1900	1899
		acres	acres	acres	acres
<b>TOTAL AREA OF LAND AND WATER (a) .</b>		<b>56,782,053</b>	<b>56,782,053</b>	<b>77,681,644</b>	<b>77,681,644</b>
<b>TOTAL ACREAGE under CROPS &amp; GRASS (b)</b>		<b>32,437,386</b>	<b>32,457,107</b>	<b>47,789,444</b>	<b>47,785,370</b>
<b>CORN CROPS.</b>	Wheat . . . . .	1,845,042	2,000,981	1,901,014	2,055,383
	Barley or Bere . . . . .	1,980,265	1,982,108	2,172,140	2,159,296
	Oats . . . . .	3,076,088	2,959,755	4,145,633	4,109,964
	Rye . . . . .	53,564	52,236	65,047	64,440
	Beans . . . . .	263,240	249,056	265,742	251,191
	Peas . . . . .	157,209	162,751	157,815	162,325
	<b>TOTAL . . . . .</b>	<b>7,335,408</b>	<b>7,406,837</b>	<b>8,707,391</b>	<b>8,803,599</b>
<b>GREEN CROPS.</b>	Potatoes . . . . .	561,361	547,682	1,227,569	1,222,614
	Turnips and Swedes . . . . .	1,688,606	1,740,993	1,994,421	2,060,472
	Mangel . . . . .	414,416	373,942	484,050	437,307
	Cabbage, Kohl-Rabi, & Rape . . . . .	195,683	173,036	242,967	219,283
	Vetches or Tares . . . . .	177,951	185,891	181,679	189,769
	<b>Other Green Crops . . . . .</b>	<b>142,105</b>	<b>127,559</b>	<b>171,088</b>	<b>154,568</b>
	<b>TOTAL . . . . .</b>	<b>3,180,122</b>	<b>3,149,103</b>	<b>4,301,774</b>	<b>4,274,063</b>
<b>CLOVER, SAINFOIN, and GRASSES under Rotation.</b>	For Hay . . . . .	2,201,781	2,214,883	2,822,418	2,852,544
	Not for Hay . . . . .	2,557,377	2,593,068	3,201,899	3,233,288
	<b>TOTAL . . . . .</b>	<b>4,759,158</b>	<b>4,807,951</b>	<b>6,024,317</b>	<b>6,105,832</b>
<b>PERMANENT PASTURE, or GRASS not broken up in Rotation. (b)</b>	For Hay . . . . .	4,373,099	4,339,085	5,936,717	5,839,379
	Not for Hay . . . . .	12,355,936	12,291,662	22,324,812	22,261,293
	<b>TOTAL . . . . .</b>	<b>16,729,035</b>	<b>16,630,747</b>	<b>28,261,529</b>	<b>28,100,672</b>
<b>FLAX . . . . .</b>		<b>467</b>	<b>476</b>	<b>47,794</b>	<b>35,463</b>
<b>HOPS . . . . .</b>		<b>51,308</b>	<b>51,943</b>	<b>51,308</b>	<b>51,843</b>
<b>SMALL FRUIT . . . . .</b>		<b>73,780</b>	<b>71,536</b>	<b>78,687</b>	<b>76,772</b>
<b>BARE FALLOW or Uncropped Arable Land</b>		<b>308,108</b>	<b>338,574</b>	<b>316,644</b>	<b>347,076</b>

(a) Not including foreshore and tidal water.

(b) Not including mountain and heath land.

TABLE II.—*Number of Horses, Cattle, Sheep, and Pigs returned upon June 4, 1900, and June 5, 1899, with Totals for the United Kingdom.*

		GREAT BRITAIN		UNITED KINGDOM, including ISLE OF MAN and CHANNEL ISLANDS	
		1900	1899	1900	1899
HORSES.	Used solely for Agriculture(a)	No.	No.	No.	No.
	Unbroken { 1 Year & above	1,078,371	1,085,395	(b) —	(b) —
	Horses. { Under 1 Year .	295,477	304,626	(b) —	(b) —
		126,395	126,609	(b) —	(b) —
TOTAL . . . .		1,500,143	1,516,630	2,000,402	2,028,092
CATTLE.	Cows and Heifers in-Milk or in-Calf . . . .	2,620,901	2,671,260	4,096,738	4,133,249
	Other { 2 Years and above	1,372,532	1,341,310	2,408,317	2,367,207
	Cattle. { 1 Year & under 2	1,460,808	1,388,511	2,504,686	2,391,250
		1,350,929	1,394,639	2,445,262	2,462,990
TOTAL . . . .		6,805,170	6,795,720	11,454,902	11,344,696
SHEEP.	Ewes kept for breeding .	10,350,326	10,460,837	18,941,887	19,097,534
	Other { 1 Year and above	5,963,869	6,040,600	12,112,660	12,582,691
	Sheep. { Under 1 Year .	10,378,031	10,737,317		
TOTAL . . . .		26,592,226	27,238,754	31,054,547	31,680,226
PIGS.	Sows kept for breeding .	332,521	375,911	(b) —	(b) —
	Other Pigs . . . .	2,049,411	2,247,902	(b) —	(b) —
	TOTAL . . . .	2,381,932	2,623,813	2,663,669	4,003,589

(a) Including mares kept for breeding.  
(b) Not separately shown for Ireland.

TABLE III.—*Preliminary Statement showing the Estimated Total Production of Hops in the Years 1900 and 1899, with the Acreage and Estimated Average Yield per Statute Acre, in each County of England in which Hops were grown.*

COUNTIES	Estimated total produce		Acreage		Estimated average yield per acre	
	1900	1899	1900	1899	1900	1899
	cwt.	cwt.	acres	acres	cwt.	cwt.
Gloucester . . .	235	619	47	42	5·00	14·74
Hants . . . .	12,291	30,580	2,231	2,319	5·51	13·19
Hereford . . .	32,680	83,950	7,287	7,227	4·48	11·62
Kent . . . .	230,028	418,997	31,514	31,988	7·30	13·10
Salop . . . .	690	966	138	138	5·00	7·00
Suffolk . . . .	7	34	4	4	1·75	8·50
Surrey . . . .	5,311	15,213	1,300	1,388	4·09	10·96
Sussex . . . .	39,717	73,807	4,823	4,949	8·23	14·91
Worcester . . .	26,935	37,207	3,964	3,788	6·79	9·82
Total . . . .	347,894	661,373	51,308	51,843	6·78	12·76

**TABLE IV.**—*Preliminary Statement showing the Estimated Total Produce and Yield per Acre of Wheat, Barley, and Oats in Great Britain in the Year 1900, with Comparative Statements for the Year 1899, and for the Average of the Ten Years 1890-99.*

**WHEAT.**

	Estimated Total Produce		Acreage		Estimated Yield per Acre		Average of the Ten Years 1890-99
	1900	1899	1900	1899	1900	1899	
	Bushels	Bushels	Acres	Acres	Bushels	Bushels	Bushels
England .	49,528,386	62,380,067	1,744,556	1,899,327	28 39	32 53	30 15
Wales .	1,332,299	1,380,938	51,654	53,898	25 79	25 62	24 15
Scotland .	1,779,125	1,768,320	48,832	47,256	36 43	37 42	36 96
Great Britain	52,639,809	65,529,325	1,845,042	2,000,981	29 53	32 75	30 15

**BARLEY.**

	Estimated Total Produce		Acreage		Estimated Yield per Acre		Average of the Ten Years 1890-99
	1900	1899	1900	1899	1900	1899	
	Bushels	Bushels	Acres	Acres	Bushels	Bushels	Bushels
England .	50,977,265	56,164,313	1,645,022	1,635,634	30 99	34 24	33 44
Wales .	3,341,872	3,323,494	105,048	105,978	31 31	31 41	30 10
Scotland .	7,998,373	8,223,891	240,195	240,496	33 29	34 19	32 20
Great Britain	62,314,510	67,711,698	1,990,265	1,982,108	31 31	34 16	32 30

**OATS.**

	Estimated Total Produce		Acreage		Estimated Yield per Acre		Average of the Ten Years 1890-99
	1900	1899	1900	1899	1900	1899	
	Bushels	Bushels	Acres	Acres	Bushels	Bushels	Bushels
England .	73,604,178	73,905,288	1,880,513	1,781,649	39 56	41 43	40 30
Wales .	7,338,305	7,527,968	216,447	220,233	33 44	34 18	33 20
Scotland .	34,005,054	33,313,304	919,128	957,873	35 83	34 78	36 45
Great Britain	114,947,537	114,746,564	3,026,088	2,959,755	37 95	38 77	38 61

# Royal Agricultural Society of England.

(Established May 9, 1838, as the ENGLISH AGRICULTURAL SOCIETY, and Incorporated by Royal Charter on March 26, 1840.)

## Patron.

(Letter from Secretary of State, dated March 6, 1840.)

## HER MOST GRACIOUS MAJESTY THE QUEEN.

President for 1899—1900.

H.R.H. THE PRINCE OF WALES, K.G.

Year when  
elected on  
Council

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Year when  
elected on  
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DARBY, ALFRED E. W., *Little Ness, Shrewsbury.*  
DEBBY, Earl of, K.G., *Knowsley, Prescot, Lancashire.*  
DUGDALE, J. MARSHALL, *Llwyn, Llanfyllin (vis Onestry), Mont.*  
\*FOSTER, S. P., *Killhow, Carlisle, Cumberland.*  
\*FRANKISH, WILLIAM, *Limber, near Brocksby, Lincolnshire.*  
GORRINGE, HUGH, *Ashcroft, Kingston-by-Sea, Brighton, Sussex.*  
\*GRANBY, Marquis of, *Belvoir Castle (Grantham), Leicestershire.*  
\*GREENVILLE, R. NEVILLE, *Butleigh Court, Glastonbury, Somerset.*  
\*HORNSBY, JAMES, *Lawton Park (Stamford), Northamptonshire.*  
JERSEY, Earl of, G.C.M.G., *Middleton Park, Bicester, Oxon.*  
\*LEVETT, Captain W. S. B., *Milford Hall, Stafford.*  
MAINWARING, C. S., *Cerrig-y-druidion, Corwen, North Wales.*  
\*MARSHALL, HENRY D., *Carr House, Gainsborough, Lincolnshire.*  
MARTIN, JOSEPH, *Highfield House, Littleport, Isle of Ely, Cambs.*  
MIDDLETON, Lord, *Birdsall House, York.*  
MILLER, T. HORROCKS, *Singleton Park, Poulton-le-Fylde, Lancashire.*  
\*MUNTZ, PHILIP ALBERT, M.P., *Dunsmore, Rugby, Warwickshire.*  
PEASE, ALFRED E., M.P., *Pinchinthorpe House, Guisborough, Yorkshire.*  
PELL, ALBERT, *Haselbeach, Northampton.*  
\*RANSOME, J. E., *Holme Wood, Ipswich, Suffolk.*  
REYNARD, FREDERICK, *Sunderlandwick, Driffield, Yorkshire.*  
\*ROGERS, O. COLTMAN, *Stanage Park, Brampton Bryan, Herefordshire.*  
ROWLANDSON, SAMUEL, *Newton Morrell, Barton R.S.O., Yorkshire.*  
\*RYLAND, HOWARD P., *Mowhull Park, Erdington, Birmingham.*  
\*SANDAY, GEORGE H., *Highfield, Uxbridge, Middlesex.*  
SMITH, ALFRED J., *Rendlesham, Woodbridge, Suffolk.*  
\*SMITH, HENRY, *The Grove, Cropwell Butler, near Nottingham.*  
STANYFORTH, E. WILFRID, *Kirk Hammerton Hall, York.*  
\*STRATTON, RICHARD, *The Duffryn, Newport, Monmouthshire.*  
\*SUTTON, MARTIN J., *Henley Park, Oxon.*  
TAYLOR, GARRETT, *Trowse House, Norwich.*  
TERRY, JOSEPH P., *Berry Field, Aylesbury, Buckinghamshire.*  
\*WARREN, REGINALD AUGUSTUS, *Preston Place, near Worthing, Sussex.*  
\*WHEELER, E. VINCENT V., *Newnham Court, Tenbury, Worcestershire.*  
\*WILLIAMS, J. C., *Caerhays Castle, St. Austell, Cornwall.*  
WILSON, C. W., *Rigmaden Park, Kirkby Lonsdale, Westmorland.*

[2 vacancies]

**STANDING COMMITTEES.**

\*. \* The PRESIDENT is a Member *ex officio* of all Committees, and the TRUSTEES and VICE-PRESIDENTS are Members *ex officio* of all Standing Committees except the Committee of Selection.

**Finance Committee.**

KINGSCOTE, Col. Sir NIGEL  
(Chairman).  
THOROLD, Sir J. H., Bart.  
ASHWORTH, A.

CORNWALLIS, F. S. W., M.P.  
CRUTCHLEY, PERCY.  
FRANKISH, W.  
SANDAY, G. H.

**House Committee.**

CHAIRMAN of Finance Committee.  
THE PRESIDENT.  
BRIDPORT, Gen. Viscount.  
PARKER, Hon. C. T.

RIDLEY, Sir M. W., Bart., M.P.  
GILBEY, Sir WALTER, Bart.  
WILSON, Sir JACOB.

**Journal Committee.**

THOROLD, Sir J. H., Bart.  
(Chairman).  
CAWDOR, Earl.  
DERBY, Earl of, K.G.

JERSEY, Earl of, G.C.M.G.  
ASHWORTH, A.  
CORNWALLIS, F. S. W., M.P.  
FRANKISH, W.  
MAINWARING, C. S.  
PELL, ALBERT.  
SUTTON, MARTIN J.  
WHITEHEAD, CHAS.

**Chemical and Woburn Committee.**

STANYFORTH, E. W.  
(Chairman).  
BEDFORD, Duke of.  
CAWDOR, Earl.  
PARKER, Hon. C. T.  
LAWES, Sir J. B., Bart.

THOROLD, Sir J. H., Bart.  
ARKWRIGHT, J. H.  
BOWEN-JONES, J.  
GREENVILLE, R. NEVILLE.  
LEVETT, Capt. W. S. B.  
PELL, ALBERT.  
REYNARD, F.  
ROWLANDSON, S.  
RYLAND, H. P.  
SUTTON, MARTIN J.  
TERRY, J. P.  
WARREN, R. A.

**Botanical and Zoological Committee.**

WHEELER, E. V. V.  
(Chairman).  
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PARKER, Hon. C. T.  
THOROLD, Sir J. H., Bart.  
ARKWRIGHT, J. H.

ASHWORTH, A.  
BOWEN-JONES, J.  
CORNWALLIS, F. S. W., M.P.  
FRANKISH, W.  
HORNSBY, J.  
MAINWARING, C. S.  
PELL, ALBERT.  
RANSOME, J. E.  
ROGERS, C. C.  
WHITEHEAD, CHAS.  
WILLIAMS, J. C.

**Veterinary Committee.**

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MORETON, Lord.  
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KINGSCOTE, Col. Sir NIGEL.  
WILSON, Sir JACOB.  
BROWN, Prof. Sir GEORGE.

ASHWORTH, A.  
CAVENDISH, VICTOR, M.P.  
CHANDOS-POLE-GELL, H.  
CRUTCHLEY, PERCY.  
CURTIS-HAYWARD, Lt.-Col.  
DARBY, ALFRED.  
GORRINGE, HUGH.  
LEVETT, Capt. W. S. B.  
McFADYEAN, Prof.  
MASTER OF FARRIERS' COMPANY.  
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**Stock-Prizes Committee.**

SANDAY, G. H. (Chairman).  
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CRUTCHLEY, PERCY.  
DARBY, ALFRED.  
DUGDALE, J. MARSHALL.  
FOSTER, S. P.  
FRANKISH, W.  
MAINWARING, C. S.  
MARTIN, JOSEPH.  
MILLER, T. H.  
PEASE, A. E., M.P.  
REYNARD, F.

ROGERS, C. C.  
RYLAND, H. P.  
SMITH, A. J.  
SMITH, HENRY.  
STANYFORTH, E. W.  
TAYLOR, GARRETT.  
TERRY, J. P.  
WHEELER, E. V. V.  
WILLIAMS, J. C.  
The Stewards of Live

**Standing Committees.****Implement Committee.**

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PARKER, Hon. C. T.	GRENVILLE, B. NEVILLE.	RYLAND, H. P.
THOROLD, Sir J. H., Bart.	HORNSBY, JAMES.	SANDAY, G. H.
WILSON, Sir JACOB.	LEVETT, Capt. W. S. B.	SMITH, A. J.
ASHETON, R. C.	MARSHALL, H. D.	STANYFORTH, E. W.
BOWEN-JONES, J.	MARTIN, JOSEPH.	The Stewards of Im-
CRUTCHLEY, PERCY.	RANSOME, J. E.	plements.

**General Park Committee.**

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FOSTER, Alderman.	

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ARKWRIGHT, J. H.	Lt.-Col.	WHEELER, E. V. V.
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SIR ERNEST CLARKE, 13 Hanover Square, W.

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**GEOGRAPHICAL DISTRIBUTION OF MEMBERS OF THE COUNCIL  
AND OF GOVERNORS AND MEMBERS OF THE SOCIETY.**

DISTRICTS	COUNTIES	NUMBER OF GOVERNORS AND MEMBERS	NUMBER OF MEMBERS OF COUNCIL	NAMES OF MEMBERS OF COUNCIL
A	BEDFORDSHIRE . .	129	1	Duke of Bedford, v.P.
	BUCKINGHAMSHIRE	140	1	Jos. P. Terry.
	CAMBRIDGESHIRE .	199	1	Joseph Martin.
	ESSEX . . . . .	246	1	Sir Walter Gilbey, T.
	HERTFORDSHIRE .	177	1	Sir J. B. Lawes, T.
	HUNTINGDONSHIRE	73	—	
	LONDON . . . . .	509	2	H.R.H. the Duke of York, K.G., T.; Rt. Hon. H. Chaplin, v.P.
	MIDDLESEX . . . .	83	1	G. H. Sanday.
	NORFOLK . . . . .	283	2	H.R.H. the Prince of Wales, K.G., P.; Garrett Taylor.
	OXFORDSHIRE . . .	148	3	Earl of Jersey; Lord Moreton, v.P.; M. J. Sutton.
	SUFFOLK . . . . .	230	2	J. E. Ransome; A. J. Smith.
		—2,217	— 15	
B.	CUMBERLAND . . .	144	1	S. P. Foster.
	DURHAM . . . . .	192	1	Earl of Ravensworth, v.P.
	NORTHUMBERLAND	250	2	Sir M. White Ridley, T.; Sir Jacob Wilson, v.P.
	WESTMORLAND . .	79	2	Lord Brougham and Vaux C. W. Wilson.
		—665	— 6	
C	DERBYSHIRE . . .	224	1	H. Chandos-Pole-Gell, v.P.
	LEICESTERSHIRE .	217	1	Marquis of Granby.
	LINCOLNSHIRE . .	306	3	Sir J. H. Thorold T.; W. Frankish; H. D. Marshall.
	NORTHAMPTONSHIRE	185	3	Earl Spencer, K.G., T.; J. Hornsby; A. Pell
	NOTTINGHAMSHIRE	225	1	Henry Smith.
	RUTLAND . . . . .	39	—	
		—1,196	— 9	

DISTRIBUTION OF MEMBERS OF THE SOCIETY—*continued.*

DISTRICTS	COUNTIES	NUMBER OF GOVERNORS AND MEMBERS	NUMBER OF MEMBERS OF COUNCIL	NAMES OF MEMBERS OF COUNCIL
D.	BERKSHIRE . . .	199	3	{ H.R.H. Prince Christian, K.G., v.p.; Visct. Bridport, T.; P. Crutchley. J. C. Williams. Sir M. Lopes, v.p.
	CORNWALL . . .	113	1	
	DEVONSHIRE . . .	141	1	
	DORSETSHIRE . . .	76	—	{ Viscount Baring. C. Whitehead, v.p.; Lord Arthur Cecil; F. S. W. Cornwallis. R. Neville Grenville.
	HAMPSHIRE . . .	228	1	
	KENT . . . . .	536	3	
	SOMERSETSHIRE . .	118	1	{ Duke of Richmond and Gordon, K.G., T.; H. Gorringe; R. A. Warren. G. Blake.
	SURREY . . . . .	229	—	
	SUSSEX . . . . .	338	3	
E.	WILTSHIRE . . .	143	1	{ Earl of Feversham, v.p.; Lord Middleton; A. E. Pease; F. Reynard; S. Rowlandson; E. W. Stanyforth. Col. Sir Nigel Kingscote, T.; Lt.-Col. J. F. Curtis-Hayward. J. H. Arkwright; C. C. Rogers. R. Stratton. J. Bowen-Jones; A. Darby. Capt. W. S. B. Levett. P. A. Munts; H. P. Byland. Earl of Coventry, v.p.; E. V. V. Wheeler Earl Cawdor, T.
	—2,121	—	14	
	YORKSHIRE . . .	—840	6	
F.	GLOUCESTERSHIRE .	282	2	{ Earl Egerton of Tatton, T.; Hon. Cecil T. Parker, v.p.; A. Ashworth. Earl of Derby, K.G.; R. C. Aasheton; Victor C. W. Cavendish; T. H. Miller. J. M. Dugdale; C. S. Mainwaring.
	HEREFORDSHIRE .	148	2	
	MONMOUTHSHIRE .	46	1	
	SHROPSHIRE . . .	337	2	{ Earl of Derby, K.G.; R. C. Aasheton; Victor C. W. Cavendish; T. H. Miller. J. M. Dugdale; C. S. Mainwaring.
	STAFFORDSHIRE . .	312	1	
	WARWICKSHIRE . .	298	2	
	WORCESTERSHIRE .	217	2	{ Earl of Derby, K.G.; R. C. Aasheton; Victor C. W. Cavendish; T. H. Miller. J. M. Dugdale; C. S. Mainwaring.
	SOUTH WALES . . .	183	1	
	—1,823	—	13	
G.	CHESHIRE . . . . .	491	3	{ Earl of Derby, K.G.; R. C. Aasheton; Victor C. W. Cavendish; T. H. Miller. J. M. Dugdale; C. S. Mainwaring.
	LANCASHIRE . . .	517	4	
	NORTH WALES . . .	215	2	
—		—1,223	—	9
SCOTLAND . . . . .		233		
IRELAND . . . . .		168		
CHANNEL ISLANDS . . . . .		11		
ISLE OF MAN . . . . .		17		
FOREIGN COUNTRIES . . . . .		189		
HONORARY MEMBERS . . . . .		24		
—		—642		
GRAND TOTALS . . . . .		10,727	72	

## GOVERNORS OF THE SOCIETY.

	Date of election as Member	Date of election as Governor
P H.R.H. THE PRINCE OF WALES, K.G....Marlborough House, S.W., and Sandringham, Norfolk	—	Feb. 3, 1864
†H.R.H. THE DUKE OF SAXE-COBURG AND GOTHA (DUKE OF EDINBURGH), K.G....Clarence House, St. James's, S.W.	—	Aug. 6, 1884
T †H.R.H. THE DUKE OF YORK, K.G....York House, St. James's Palace, S.W., and Sandringham, Norfolk	—	April 6, 1892
†H.R.H. THE DUKE OF CAMBRIDGE, K.G....Gloucester House, Piccadilly, W.	—	Aug. 6, 1862
VP H.R.H. PRINCE CHRISTIAN OF SCHLESWIG-HOLSTEIN, K.G....Cumberland Lodge, Windsor	—	Aug. 4, 1875
†ALLCROFT, Herbert John...Stokesay Court, Onibury, Salop	—	Dec. 12, 1888
†AMHERST OF HACKNEY, Leovd...Didlington Hall, Brandon	Feb. 2, 1859	May 7, 1890
ANCASTER, Earl of...Normanton Park, Stamford	Mar. 3, 1869	May 5, 1875
ARCHER-HOUBLON, George B....Hallingbury Place, Bishop's Stortford	—	Mar. 6, 1889
††ARKWRIGHT, J. Hungerford...Hampton Court, Leominster	—	June 5, 1861
ASHBURTON, Lord...The Grange, Alresford, Hants	—	May 7, 1890
†ASHWORTH, Charles E....The Heath, Knutsford	July 5, 1865	July 29, 1891
BARNARD, Lord...Raby Castle, Darlington	—	July 27, 1892
*BATTEN, John...Aldon, Yeovil, Somersetshire	July 16, 1839	Mar. 5, 1890
VP †BEDFORD, Duke of...Woburn Abbey, Bedfordshire	—	May 3, 1893
†BEEVER, W. F. Holt...Yewden Lodge, Henley-on-Thames	April 2, 1879	June 6, 1894
†BELPER, Lord...Kingston, Derby	July 6, 1881	Mar. 6, 1895
†BENF, Thomas G....Reigny House, Newton Reigny, Penrith	Mar. 13, 1878	Aug. 2, 1882
†BLYTH, Sir James, Bart...Blythwood, Stansted, Essex	Nov. 3, 1875	July 27, 1892
BRASSEY, Henry Leonard C....Preston Hall, Aylesford, Kent	—	Feb. 3, 1892
T BRIDFORD, Gen. Viscount, G.C.B....Royal Lodge, Windsor Great Park, Berkshire	Jan. 19, 1842	April 2, 1862
†BROOKS, Sir William Cunliffe, Bart...Barlow Hall, Chorlton-cum-Hardy, Manchester	—	Aug. 7, 1872
BURGHCLERE, Lord...48 Charles Street, Berkeley Square, W.	—	Dec. 7, 1892
BURTON, Lord...Rangemore, Burton-on-Trent	Nov. 7, 1888	June 25, 1890
BUTE, Marquis of, K.T....Mount Stuart, Rothesay, N.B.	—	April 4, 1894
CADOGAN, Earl, K.G....Culford Hall, Bury St. Edmunds	—	Dec. 11, 1889
†CAIRD, James A...Cassencary, Creetown, N.B.	May 7, 1873	July 31, 1895
CALTHORPE, Lord...Elvetham, Winchfield	Nov. 7, 1883	May 2, 1894
†CATHCART, Earl...Thornton-le-Street, Thirsk	Feb. 6, 1856	April 3, 1867
††CAVENDISH, Victor C.W., M.P....Holker Hall, Cark-in-Cartmel, Lancashire	—	Mar. 2, 1892
T†CAWDORE, Earl...Stackpole Court, Pembrokeshire	Mar. 3, 1863	Mar. 2, 1892
†CAWSTON, George...The Manor House, Cawston, Norfolk	—	June 6, 1894
VP †CHANDOS-POLE-GELL, H....Hopton Hall, Wirksworth, Derbyshire	Nov. 6, 1861	June 23, 1891
VP CHAPLIN, Rt. Hon. Henry, M.P....Stafford House, S.W.	—	Nov. 2, 1870
CHELSEA, Viscount, M.P....31A Green Street, Park Lane, W.	—	Feb. 6, 1895
†CLARENDON, Earl of...The Grove, Watford	June 5, 1872	May 2, 1894
†CLINTON, Lord...Heanton Satchville, Beaford, N. Devon	April 3, 1867	April 2, 1890
CLITHEROW, Colonel Edward J. S....Hotham Hall, Brough, Yorkshire	—	Feb. 6, 1889
†CORBETT, John...Impney, Droitwich	July 2, 1873	Feb. 4, 1891
†CORNWALLIS, Fiennes S. W., M.P....Linton Park, Maidstone	—	July 2, 1884

P President.

\* Elected a Foundation Life Governor, March 5, 1890.

† Life Governor.

T Trustee,

VP Vice-President.

| Member of Council.

	Date of election as Member	Date of election as Governor
<b>VP†</b> COVENTRY, Earl of...Croome Court, Severn Stoke, Woro.	April 1, 1863	April 4, 1894
†COWPER, Earl, K.G....Panshanger, Hertford	—	April 7, 1875
†CRAVEN, Thomas...Woodheyas Park, Ashton-on-Mersey	May 6, 1891	Dec. 6, 1893
CREWE, Earl of...Crewe Hall, Crewe, Cheshire	Feb. 6, 1884	Mar. 7, 1894
DARTMOUTH, Earl of...Patshull Hall, Wolverhampton	—	Dec. 9, 1891
†DERBY, Earl of, K.G., G.C.B....Knowsley, Prescott	June 3, 1874	May 2, 1894
DERWENT, Lord...Hackness Hall, Scarborough	—	April 7, 1869
†DE TRAFFORD, Sir H. F., Bart....18 Arlington Street, W.	Aug. 1, 1883	June 1, 1892
†DEVONSHIRE, Duke of, K.G....Chatsworth, Chesterfield	—	June 2, 1880
†DEWHURST, G. Littleton...Beechwood, Lymm, Cheshire	Dec. 9, 1891	May 2, 1894
†DICKSON-POYNDEY, Sir J., Bart., M.P....Hartham Park, Corsham, Wilts	Nov. 2, 1887	April 2, 1890
DIGBY, Lord...Minterne House, Cerne Abbas, Dorset	—	July 25, 1894
†DULEEP-SINGH, Prince Frederick...Hockwold Hall, Brandon	—	July 25, 1894
DUNCOMBE, W. H. O....Waresley Park, Sandy, Beds	April 1, 1885	May 6, 1896
†DUNMORE, Earl of...Carlton Club, Pall Mall, S.W.	—	Feb. 3, 1869
†DUNHAM, Earl of...Lambton Castle, Durham	—	July 14, 1880
T EGBERTON OF TATTON, Earl...Tatton Park, Knutsford	Mar. 6, 1872	Nov. 7, 1883
†ELLESMERE, Earl of...Worsley Hall, Manchester	—	July 7, 1869
ESSEX, Earl of...Cassiobury Park, Watford	Nov. 7, 1888	Nov. 2, 1892
EXETER, Marquis of...Burghley House, Stamford	May 4, 1898	June 21, 1898
<b>VP</b> FEVERSHAM, Earl of...Duncombe Park, Helmsley, Yorks	Mar. 5, 1862	Mar. 3, 1875
†FIELDEN, Thomas...Grimston Park, Tadcaster	Aug. 6, 1879	Mar. 6, 1895
FIFE, Duke of, K.T....15 Portman Square, W.	—	Nov. 7, 1888
FITZWILLIAM, Earl, K.G....Wentworth Woodhouse, Rotherham	—	June 5, 1872
*FLETCHER, John Philip...Darby Lodge, Sunbury-on-Thames	Feb. 19, 1840	Mar. 5, 1890
†FORTESCUE, Earl...Castle Hill South Molton	—	Nov. 6, 1861
†FREEMAN-MITFORD, A. B., C.B....Batsford Park, Moreton-in-the- Marsh, Gloucestershire	—	Nov. 3, 1886
†FYTCHE, J. Lewis...The Terrace, Freshwater, Isle of Wight	April 5, 1854	June 4, 1879
T GILBEY, Sir Walter, Bart...Elsenham Hall, Essex	Nov. 2, 1870	June 5, 1889
GLENECK, Lord...Heath House, Hampstead Heath, N.W.	—	Dec. 12, 1888
GORDON, H. Panmure...Loudwater House, Rickmansworth	July 27, 1892	Mar. 1, 1893
GRAFTON, Duke of, K.G....Wakefield Lodge, Stony Stratford	—	June 3, 1884
GRAHAM, Sir Reginald H., Bart....Norton Conyers, Ripon	Nov. 1, 1882	June 25, 1895
†GRANT, Sir G. Macpherson, Bt....Ballindalloch Castle, N.B.	April 1, 1863	April 2, 1890
†GREENALL, Sir Gilbert, Bart....Walton Hall, Warrington	Feb. 3, 1892	May 2, 1894
GRIFFITHS, John James...Highbury Grange, Highbury, N.	—	May 1, 1889
GROVES, James G....Oldfield Hall, Altrincham	—	May 1, 1895
GWYNNE, John...Kenton Grange, The Hyde, N.W.	—	Mar. 5, 1879
HAREWOOD, Earl of...Goldsboro' Hall, Knaresborough	June 6, 1883	Nov. 2, 1892
HAY, Arthur W. H....Oakley Park, Hoxne, Suffolk	—	Nov. 4, 1896
†HENDERSON, Alexander, M.P....Buscot Park, Faringdon, Berks.	Nov. 5, 1890	July 28, 1897
HENRY, Mitchell...Kylmore Castle, co. Galway	Nov. 7, 1877	Dec. 10, 1890
HERTFORD, Marquis of...Ragley Park, Alcester	Aug. 2, 1882	May 7, 1884
†HEYWOOD, Sir A. Percival, Bt....Duffield Bank, Derby	April 7, 1875	Feb. 2, 1898
HODGSON, John...Nocton Hall, Nocton, Lincolnshire	—	Mar. 2, 1898
†HOLFORD, Capt. George L., C.I.E....Westonbirt, Tetbury, Glos.	—	April 6, 1892
†HOPETOUN, Earl of...Hopetoun House, South Queensferry, N.B.	Nov. 7, 1888	July 31, 1895
†HORNSBY, James...Laxton Park, Stamford	June 6, 1878	May 29, 1895
†HOTFIELD, Lord...Hothfield Place, Ashford, Kent	—	May 7, 1879

\* Elected a Foundation Life Governor, March 5, 1890.  
T Trustee. VP Vice-President.

† Life Governor.  
| Member of Council.

	Date of election as Member	Date of election as Governor
HUTH, Louis...Possingworth, Cross-in-Hand, Hawkhurst . . . . .	Dec. 12, 1888	Feb. 6, 1895
†IRWIN, Colonel T. A....Lynehow, Carlisle . . . . .	May 5, 1880	June 25, 1895
†IVEAGH, Lord, K.P....5 Grosvenor Place, S.W. . . . .	—	June 6, 1894
†JERSEY, Earl of, G.C.M.G....Middleton Park, Bicester . . . . .	June 30, 1875	April 4, 1894
JOICEY, E....Blenkinsopp Hall, Haltwhistle, Northumberland . . . . .	—	Dec. 12, 1888
†JONES, Walter J. H....Blakemere, Hartford, Cheshire . . . . .	April 11, 1888	May 2, 1894
*KEMBLE, Thomas...Runwell Hall, Wickford, Essex . . . . .	July 10, 1839	Mar. 5, 1890
T†KINGSCOTE, Col.'Sir Nigel, K.C.B....Kingscote, Wotton-under-Edge, Gloucestershire . . . . .	April 6, 1854	July 1, 1874
KOHLAPUR, H.H. The Maharajah of...Kohlapur, India . . . . .	—	Feb. 6, 1889
†KYNNEBURY, Thomas F....Leighton Hall, Ironbridge, Salop . . . . .	Nov. 7, 1883	Nov. 4, 1891
†LANSDOWNE, Marquis of, K.G....Bowood, Calne, Wilts. . . . .	Feb. 3, 1875	Feb. 5, 1896
T†LAWES, Sir J. B., Bart....Rothamsted, St. Albans . . . . .	April 29, 1846	Dec. 11, 1878
†LECONFIELD, Lord...Petworth House, Sussex . . . . .	—	June 5, 1872
†LEICESTER, Earl of, K.G....Holkham Hall, Norfolk . . . . .	—	Nov. 15, 1843
†LEIGH, Lord...Stoneleigh Abbey, Kenilworth. . . . .	—	Dec. 1, 1858
†LLANGATTOCK, Lord...The Hendre, Monmouth . . . . .	Mar. 1, 1871	May 2, 1894
†LONDSEBOROUGH, Earl of...Londesborough Pk., Market Weighton	Nov. 5, 1862	April 2, 1890
LONDONERRY, Marquis of, K.G....Seaham Hall, Seaham Harbour, Co. Durham . . . . .	—	June 3, 1885
†LONG, Rt. Hon. W. H., M.P....Rood Ashton, Trowbridge . . . . .	Aug. 4, 1880	Dec. 11, 1895
†LONSDALE, Earl of...Lowther Castle, Penrith . . . . .	—	July 4, 1883
VP†LOPES, Rt. Hon. Sir Massey, Bt...Maristow, Roborough, Devon	Mar. 15, 1848	May 7, 1884
LUCAS, Sir Thomas, Bart...12a Kensington Palace Gardens, W. . . . .	—	Dec. 12, 1888
MCCALMONT, Harry, M.P....Cheveley Park, Newmarket . . . . .	—	Feb. 7, 1894
†MACDONALD, Sir A. K., Bart...Woolmer Lodge, Liphook . . . . .	July 31, 1849	Nov. 1, 1871
MARSHALL, William...Mere House, Weaverham, Northwich . . . . .	April 6, 1892	April 7, 1897
†MASON, James...Eynaham Hall, Witney, Oxon. . . . .	May 1, 1867	May 2, 1894
†MIDDLETON, Lord...Birdsall House, York . . . . .	—	Mar. 3, 1875
*MONCK, J. Bligh...Coley Park, Reading . . . . .	May 23, 1839	Mar. 5, 1890
†MOORSON-MITCHINSON-MAUDE, C. R....Harewood, Leeds . . . . .	Dec. 2, 1857	July 26, 1893
VP†MORETON, Lord...Sarsden House, Chipping Norton, Oxon. . . . .	—	Mar. 3, 1875
†MOREWOOD, C. R. Palmer...Alfreton Park, Derbyshire . . . . .	April 7, 1875	Feb. 7, 1894
†MORRELL, Lt.-Col. G. H., M.P....Headington Hill Hall, Oxford.	June 6, 1878	July 25, 1894
†MOUNT-EDGCUMBE, Earl of...Mount-Edgcumbe, Plymouth . . . . .	Nov. 6, 1861	Mar. 5, 1890
MUNCASTER, Lord...Muncaster Castle, Ravensglass, Cumberland	—	June 23, 1891
†MUNTZ, George F...Umberslade Park, Birmingham . . . . .	Dec. 4, 1867	June 30, 1875
NEELD, Sir Algernon W., Bart...Grittleton, Chippenham . . . . .	Nov. 7, 1888	Dec. 9, 1891
NORFOLK, Duke of, K.G....Arundel Castle, Sussex . . . . .	—	July 29, 1891
†NORTHBROOK, Earl of...Stratton, Micheldever Station, Hants . . . . .	—	June 2, 1880
†PALMER, Walter...Frogna, Sunninghill, Berks. . . . .	—	Feb. 1, 1899
PARK, Philip...The Oaks, Penwortham, Preston . . . . .	—	Nov. 4, 1896
VP†PARKER, Hon. Cecil T...Eccleston, Chester . . . . .	April 7, 1876	May 25, 1898
†PEEL, Edmund. Brynnypps, Eilemoro . . . . .	Feb. 3, 1858	Mar. 5, 1890
†PLATT, Col. Henry...Gordding, Llanfairfechan . . . . .	Mar. 5, 1862	Feb. 3, 1897
†PLATT, James E. . Bruntwood, Cheadle, Cheshire . . . . .	June 30, 1886	May 1, 1895
†PORTLAND, Duke of, K.G...Welbeck Abbey, Worksop . . . . .	—	June 2, 1880
†PORTMAN, Viscount...Bryanston, Blandford . . . . .	Aug. 6, 1862	Mar. 5, 1880
PORTSMOUTH, Earl of...Hurstbourne Park, Whitechurch, Hants . . . . .	—	Dec. 9, 1891
†POWIS, Earl of...Powis Castle, Welshpool . . . . .	April 6, 1887	June 23, 1891
†QUILTER, Sir W. Cuthbert, Bart., M.P...Bawdsey Manor, Wood-bridge . . . . .	Mar. 3, 1886	April 7, 1897

\* Elected a Foundation Life Governor, March 5, 1890.  
T Trustee. VP Vice-President.

† Life Governor.  
‡ Member of Council.

## List of Governors.

	Date of election as Member	Date of election as Governor
†RAMSDEN, Lt.-Col. W. J. F... Rogerthorpe Manor, Pontefract . . .	May 2, 1883	June 25, 1895
VP RAVENSWORTH, Earl of...Ravensworth Castle, Gateshead . . .	Feb. 5, 1868	July 1, 1885
REISS, James E....86 Cadogan Square, S.W. . . . .	Feb. 7, 1883	May 2, 1894
T*†RICHMOND & GORDON, Duke of, K.G...Goodwood, Chichester	June 20, 1838	Dec. 2, 1868
T†RIDLEY, Rt. Hon. Sir Matthew W., Bart., M.P....Blagdon, Cramlington, Northumberland . . . . .	April 7, 1869	May 5, 1886
RIPON, Marquis of, K.G....Studley Royal, Ripon . . . . .	—	July 3, 1861
ROLLE, Hon. Mark...Bicton, Budleigh Salterton, Devon . . .	—	Nov. 7, 1894
†ROSEBURY, Earl of, K.G...38 Berkeley Square, W. . . . .	—	June 6, 1894
ROTHSCHILD, Leopold de...Ascott, Wing, Leighton Buzzard . .	—	Mar. 1, 1893
ROTHSCHILD, Lord...148 Piccadilly, W. . . . .	Nov. 7, 1888	June 4, 1890
RUTLAND, Duke of, K.G....Belvoir Castle, Leicestershire . .	Dec. 12, 1888	Dec. 9, 1891
†SALISBURY, Marquis of, K.G....Hatfield House, Herts . . . .	—	Feb. 6, 1889
SALOMONS, Leopold...Norbury Park, Dorking . . . . .	—	May 6, 1896
†SCHÖDDE, Baron J. H. W....The Dell, Egham, Surrey . . . .	Nov. 3, 1869	April 2, 1890
*§SIMONDS, Prof. James Beart...St. John's Villa, Ryde, I.W. .	July 25, 1838	Mar. 5, 1890
*SIMONDS, W. Barrow...Abbotts Barton, Winchester . . . .	June 19, 1839	Mar. 5, 1890
SMITH, Hon. W. F. D., M.P...3 Grosvenor Place, S.W. . . . .	—	Dec. 9, 1891
†SMYTH, Sir J. H. Greville, Bart...Aughton Court, Bristol . .	—	July 3, 1878
*SPARKS, Major William...Crewkerne, Somerset . . . . .	June 6, 1838	Mar. 5, 1890
T SPENCER, Earl, K.G...Althorp Park, Northampton . . . .	Dec. 5, 1860	Mar. 3, 1875
†STANFORTH, E. W....Kirk Hammerton Hall, York . . . . .	Feb. 6, 1884	July 31, 1895
*STRATTON, J. Locke...Turweston House, Brackley . . . . .	May 13, 1839	Mar. 5, 1890
STUBS, Peter...Blaisdon Hall, Newnham, Glos. . . . .	July 27, 1892	Dec. 12, 1894
SUTHERLAND, Duke of...Trentham, Stoke-on-Trent . . . .	Mar. 1, 1882	Dec. 7, 1892
†SUTTON, Martin J...Henley Park, Oxfordshire . . . . .	May 1, 1878	Feb. 1, 1882
†SWINBURNE, Sir John, Bart....Capheaton, Newcastle-on-Tyne .	May 1, 1867	May 7, 1890
†TANQUERAY, John S...Balmain, 5 Albany Road, St. Leonards .	Feb. 16, 1848	May 8, 1849
†THOMPSON, Henry Yates...19 Portman Square, W. . . . .	—	Nov. 7, 1894
T†THOROLD, Sir John H., Bart....Syston Park, Grantham . . .	Aug. 5, 1868	May 1, 1889
TREDEGAR, Lord...Tredegar Park, Newport, Mon. . . . .	—	May 3, 1876
†TREMAYNE, John...Heligan, St. Austell, Cornwall . . . . .	July 8, 1863	Feb. 6, 1895
TURBERVILL, Col. J. P....Ewenny Priory, Bridgend . . . . .	Mar. 5, 1884	July 27, 1892
†TWEEDMOUTH, Lord...Guisachan, Beaulieu, N.B. . . . .	—	July 31, 1889
WALTER, Arthur F....Bearwood, Wokingham . . . . .	—	Mar. 6, 1895
†WANTAGE, Lord, V.C...Lockinge, Wantage . . . . .	June 3, 1863	May 1, 1872
†WARREN, Reginald A....Preston Place, Worthing . . . . .	June 3, 1857	June 6, 1894
WATSON, William C....Colworth, Bedford . . . . .	—	Dec. 11, 1895
WHITE, R. Holmes...Boulge Hall, Woodbridge . . . . .	—	Nov. 3, 1897
VP†WHITEHEAD, Charles...Barming House, Maidstone . . . .	April 1, 1857	Feb. 6, 1889
†WILLIAMS, Henry...Moor Park, Harrogate . . . . .	Aug. 1, 1883	Mar. 6, 1895
WILLOUGHBY DE BROKE, Lord...Kineton House, Warwick . . .	—	Dec. 10, 1890
VP†WILSON, Sir Jacob...Chillingham Barns, Belford, Northmbd.	Dec. 5, 1860	Dec. 7, 1892
†WINDSOR, Lord...Hewel Grange, Bromsgrove . . . . .	—	Nov. 6, 1878
†WRIGHT, William...Wollaton, Nottingham . . . . .	May 1, 1867	Dec. 12, 1894
†YERBURGH, Robert A., M.P...Billinge, Scarr, Blackburn . . .	—	Nov. 7, 1888
†ZETLAND, Marquis of, K.T...Aake Hall, Richmond, Yorks.. .	Feb. 4, 1874	May 2, 1894

\* Elected a Foundation Life Governor, March 5, 1890.  
T Trustee. VP Vice-President.

† Life Governor. § Honorary Member.  
| Member of Council.

# HONORARY MEMBERS OF THE SOCIETY.

*(" British Subjects or Foreigners who have rendered exceptional services to Agriculture or Allied Sciences," and who have been elected under Bye-law 8 as Honorary Members, without payment of subscription.)*

	Date of election as Honorary Member
ARNIM, Herr Berndt von...Criewen, Brandenburg, Germany . . . . .	June 21, 1899
BROWN, Professor Sir George T., C.B....Bryn Hyfryd, Harrow (Ordinary Member, Dec. 3, 1862) . . . . .	May 1, 1878
CARTUYVELS-VAN-DEB-LINDEN, Jules, M.A....215 Rue de la Loi, Brussels . . . . .	Dec. 11, 1895
CHAUVEAU, Prof. Auguste, M.D., LL.D....10 Avenue Jules Janin, Passy, Paris . . . . .	Dec. 6, 1893
DANNFELT, Carl Juhlin B....Consul-Genl. of Sweden and Norway, 24 Great Winchester St., E.C. . . . .	Feb. 1, 1871
DE VOGÜE, Marquis...2 Rue Fabert, Paris . . . . .	June 21, 1899
FLEISCHMANN, Prof. Wm....Director of the Agricultural Institute of the Royal University of Königsberg . . . . .	Dec. 12, 1894
FLEMING, George, LL.D., C.B....Higher Leigh, Combe Martin, North Devon . . . . .	Mar. 13, 1878
FOSTER, Prof. Sir Michael, K.C.B., M.P., Sec. R.S....Nine Wells, Great Shelford, Cambridge . . . . .	Feb. 3, 1897
GILBERT, Sir J. Henry, Ph.D., D.Sc., F.R.S....Harpenden, St. Albans . . . . .	July 4, 1883
HOHENBUCK, Baron Arthur von...I Niebelungengasse 8, Vienna . . . . .	Nov. 5, 1890
LEVEING, Prof. G. D., M.A., F.R.S....Cambridge . . . . .	Mar. 7, 1894
MARECKE, Prof. Dr. M....Versuchs-Station, Halle, Germany . . . . .	Nov. 2, 1892
NOBE, Dr. J. C. F....Director of the Experimental Station, Tharand, Saxony . . . . .	May 6, 1896
NOCARD, Prof. Edmond...Ecole Vétérinaire, Alfort, France . . . . .	Dec. 11, 1895
PASST, Louis...45 Rue de Clichy, Paris . . . . .	June 23, 1891
PROSKOWETZ, Emanuel Ritter von, Senr....Kwassitz, Moravia . . . . .	Nov. 5, 1890
SANDERSON, Dr. J. Burdon, F.R.S....Oxford . . . . .	May 1, 1878
SCHERBATOFF, Prince Alexander...President of the Imperial Agricultural Society of Moscow, Russia . . . . .	Nov. 3, 1897
SCHLIEFFEN, Count...Schlieffenburg, bei Lalendorf, Mecklenburg, Germany . . . . .	Dec. 12, 1883
SICKESZ VAN DE CLOESE, Dr. C. J....Heerengracht 17, The Hague, Holland . . . . .	Dec. 9, 1891
SIMONDS, Prof. J. Beart...St. John's Villa, Ryde, Isle of Wight (Ordinary Member, July 25, 1838) . . . . .	April 3, 1849
THIEL, Dr. H....Privy Councillor, and Director of the Department of Agricul- ture, 17 Lutherstrasse, Berlin . . . . .	Aug. 1, 1883
TISSERAND, Eugène...Ancien Directeur de l'Agriculture, 17 Rue du Cirque, Paris . . . . .	Aug. 1, 188

## SUMMARY OF MEMBERS ON THE REGISTER, MARCH 31, 1900.

9 Foundation Life Governors (Members elected before the granting of the Charter on March 26, 1840).

74 Governors paying an annual subscription of 5l.

102 Life Governors who have compounded for their annual subscriptions.

6,871 Members paying an annual subscription of 1l.

3,525 Life Members who have compounded for their annual subscriptions.

123 Life Members by Examination.

24 Honorary Members.

10,737 Total number of Governors and Members at March 31, 1900.

## REPORT OF THE AUDITORS

### ON THEIR EXAMINATION OF THE SOCIETY'S ACCOUNTS FOR THE YEAR 1899.

IN view of the fact that during the year 1899 the Society incurred a very considerable loss from the holding of its Country Meeting, which has had to be met out of its Invested Funds, we have, as requested by the Council, made a special examination of the Society's financial position, and beg to report as follows :—

1. The Society's *Invested Funds* have been diminished during the year by 1,000*l.* Consols and 6,400*l.* Harewood House Debenture Stock, which it has been necessary to realise to meet the losses on the Mail-stone Meeting and other expenditure. The value in the Society's books of the fixtures, fittings, and furniture at the offices, the machinery, Country Meeting plant, and the not culture station, has been written down during the year at the customary rates for depreciation recommended by the Auditors on March 20, 1895 (*Journal*, Vol. VI. page xii) ; and the total value of the Society's Assets was therefore reduced from 45,807*l.* 4*s.* 6*d.* on December 31, 1898, to 37,418*l.* 15*s.* 7*d.* on December 31, 1899—a decrease of 8,388*l.* 8*s.* 11*d.*

2. Since 1890 these Assets have appeared on the debit side of the Balance Sheet under two items, the first representing the *Reserve Fund*, and the second (being the balance after deducting the Reserve Fund from the total assets) representing what may be called the free *Capital* of the Society. To explain clearly these two items it will be necessary to go back to the Special Report which the Auditors of that time presented on March 2, 1891, and which is printed on pages xii and xiii of Vol. II. of the present Series of the *Journal*.

3. At that time there was a question as to "the manner in which the Life Compositions received from members in future are to be treated in the Society's accounts, and as to the contributions to the revenue of each future year which should be made in respect of the Life Compositions received in the past." It was shown by the calculations of the then Auditors that the amount of the Society's funded capital of 29,033*l.* 9*s.* 4*d.* on December 31, 1889, "was little more than sufficient to meet the future cost of providing its Life Members with the privileges which by its acceptance of their Life Compositions it has contracted to give them." The final conclusion of the Auditors was that "the simplest, best, and fairest method will be to credit all Life Compositions received in and after 1890 to the Reserve Fund, and to debit that Fund each year with the cost of providing the Life Members then on the books with their privileges."

4. The original amount of this "*Reserve Fund*" was the 29,033*l.* 9*s.* 4*d.* invested capital standing in the Balance Sheet on December 31, 1889; and each year since, there has been added to it the amount of Life Compositions received during the year, and subtracted from it a sum (from 1890-4 of 14*s.* per head, and from 1895-9 of 15*s.* per head) to represent the contribution due from each Life Member to the ordinary income of the year.

5. With the annual additions and subtractions made in accordance with the recommendations of 1891, the Reserve Fund stood, at the date of the last balance-sheet (December 31, 1898), at 22,248*l.* 7*s.* 4*d.*, whereas the invested capital of the Society stood in the books at 30,212*l.* 3*s.* 6*d.* Thus, whilst the obligations of the Society in respect of its life members had during the intervening nine years considerably decreased, the amounts of invested capital had nevertheless remained at practically the same figure as in 1889. To the extent, therefore, of the surplus of the invested capital over the Reserve Fund, the Society might be held to have accumulated some 8,000*l.* "Capital" beyond the amount ear-marked for the Life Members in the Reserve Fund. The losses from the Show of 1899 have swept most of this surplus away, and the 22,822*l.* 13*s.* 7*d.* invested capital which the Society now possesses is only 2,036*l.* 11*s.* 0*d.* more than the Reserve Fund as it now stands (20,786*l.* 2*s.* 7*d.*).

6. It was recognised in the Auditors' report of 1891 that the basis on which the calculation was made of the "*prospective claims of life members*" would need re-investigation at periodical intervals, and this was done by the Auditors in 1895 (see *Journal*, Vol. VI. pages xii and xiii), and has now been again done by us after a second quinquennial interval. The experience of the seven years preceding 1891 had been that the average period during which a Life Member remained on the Registers after his election was twenty-six years.

The further experience of 1891-4 confirmed this, and the experience of 1895-9 has still further confirmed it. The 421 Life Members struck off the books during the last five years had been on the Registers for an aggregate of 11,417 years, which is very nearly equal to twenty-seven years per Life Member. In all these calculations, however, no allowance has been made for broken periods; and as the Life Members are struck off the Registers as soon as their deaths are recorded, and their privileges are not always exercised therefore for a full year, it will be sufficient for all practical purposes to take twenty-six years as the normal period of average duration of Life Membership.

7. As shown in the table in the Auditors' Report of 1891, there were on the books at the end of 1889, 3,825 Life Members who in the aggregate had exercised their privileges for 54,374 years, or 14½ years on the average. These 3,825 Life Members of 1838-1889 were reduced at the end of 1894 to 3,528 members, who had exercised their privileges for 65,143 years, or 18½ years on the average. At the end of 1899 their number had been still further reduced to 3,207, who had exercised their privileges for 72,067 years, or 22½ years on the average. The details are shown in the following Table :—

Year of Election	No. on Books on Jan. 1			Year of Election	No. on Books on Jan. 1		
	1890	1895	1900		1890	1895	1900
1838-40	36	24	15	1866	26	21	21
1841	15	10	4	1867	30	26	25
1842	21	10	7	1868	46	48	46
1843	10	5	8	1869	96	90	74
1844	7	5	3	1870	82	79	62
1845	22	12	7	1871	81	72	76
1846	19	13	7	1872	87	80	73
1847	12	5	4	1873	102	98	87
1848	14	10	8	1874	86	79	75
1849	17	12	7	1875	148	130	126
1850	17	12	10	1876	92	88	87
1851	23	14	6	1877	93	88	88
1852	13	11	6	1878	119	106	103
1853	27	20	12	1879	262	250	223
1854	29	20	15	1880	127	119	107
1855	21	13	13	1881	96	94	83
1856	43	32	24	1882	144	133	121
1857	29	24	19	1883	210	194	180
1858	29	21	20	1884	217	212	198
1859	30	24	19	1885	136	126	111
1860	19	16	14	1886	101	97	89
1861	41	37	33	1887	90	94	97
1862	92	71	65	1888	114	119	115
1863	71	61	57	1889	506	516	493
1864	62	48	39	Total No. on Books	3,825	3,528	3,207
1865	33	30	26				

8. But these Life Members of the period before 1890 have since been recruited by other Life Members whose compositions, at the more adequate rate of 15*l.* each, have been credited to the Reserve Fund, which has to this extent been augmented. At the end of 1894 there were 352 such new Life Members, and at the end of 1899, 582 new Life Members (*i.e.* 338 + 244), as shown in the following Table:—

Year of Election	No. on Books on Jan. 1			Year of Election	No. on Books on Jan. 1		
	1890	1895	1900		1890	1895	1900
1890 . . .	—	81	75	1895 . . .	—	—	43
1891 . . .	—	72	66	1896 . . .	—	—	51
1892 . . .	—	76	73	1897 . . .	—	—	55
1893 . . .	—	64	65	1898 . . .	—	—	50
1894 . . .	—	59	59	1899 . . .	—	—	45
—	—	352	338	—	—	—	244
Total of Life Members on Books . . . . .				—	3,825	3,880	3,789

9. The whole body of Life Members for whose prospective claims the Society is bound to make provision, at present number 3,789. They have been on the books a total of 75,529 years, or an average of 20 years per member, so that if 26 years be taken as the average duration of Life Membership after election, the Society has to make provision for the cost of providing each of these 3,789 members for 6 years longer, or adding (as in the previous calculations of 1891 and 1895) a year, to compensate for the unusually large number of Life Members elected in 1889, for 7 years longer.

10. The annual cost of providing each of the members of the Society with his privileges (excluding all contingencies and the shows), has been taken for the last five years at 15*l.* per member (Journal, Vol. VI. page xiii). Latterly the cost has exceeded this sum; but as a contribution of 15*l.* per Life Member has been found in practice to balance the ordinary income and expenditure, it may be regarded as sufficient for a further five years to debit the Reserve Fund, and to credit the income of the year, with this amount. To provide 3,789 Life Members with privileges for seven years longer, at 15*l.* per member per year, will cost the Society 19,896*l.* 11*s.*, equal (allowing interest at  $2\frac{1}{2}$  per cent. to be received during the next seven years) to a present value of 18,043*l.* 7*s.* 8*d.*

11. The existing Reserve Fund of 20,786*l.* 2*s.* 7*d.* would appear, therefore, to be adequate to meet the prospective claims of Life Members, but not much more than adequate if the proportion is appreciably modified of Life Members whose annual contributions to income are paid out of the Reserve Fund, and of the other members who pay a subscription of 1*l.* every year.

A. H. JOHNSON  
HENRY GRINLING } Auditors on behalf of the Society.  
JONAS M. WEBB



respond- ing figures or 1898			£	s.	d.	£	s.	d.
10,646	By 10,000L CONSOLS at cost (Average cost 96L 15s. 6½d.) . . .					9,877	16	3
	Value on December 31, 1899, at 99½ = 9,925L.							
	[Of this 10,000L Stock, 105L is held against Special Prizes.]							
19,567	By 12,100L HAREWOOD HOUSE DEBENTURE STOCK at Average cost to Society (100L 6s. 10d.) . . . . .					12,144	17	4
3,497	By FIXTURES at Harewood House—	£	s.	d.				
262	Value at December 31, 1898 . . . . .	3,234	12	2				
	Less : Depreciation at 7½ per cent. . . . .	242	11	9				
3,235						2,992	0	5
3,262	By FURNITURE—							
155	Value at December 31, 1898 . . . . .	3,122	8	7				
3,107	Less : Depreciation at 7½ and 5 per cent. . . . .	147	11	0				
		2,974	17	7				
16	Added during 1899 . . . . .	9	11	9				
3,122						2,984	9	4
1,500	By PICTURES (800L) and BOOKS (1,000L) . . . . .					1,500	0	0
687	By MACHINERY—							
68	Value at December 31, 1898 . . . . .	618	11	3				
619	Less : Depreciation at 10 per cent. . . . .	61	17	2				
						556	14	1
4,625	By COUNTRY MEETING PLANT—							
231	Value at December 31, 1898 . . . . .	4,607	14	0				
	Less : Depreciation at 5 per cent. . . . .	230	7	9				
4,394		4,377	6	3				
214	Added during 1899 . . . . .	276	2	0				
4,608						4,762	8	3
693	By Cost of WATER PIPES (less depreciation) . . .					543	4	3
1,226	By Cost of Erection of BUILDINGS for "POT EXPERIMENTS" at Woburn . . . . .	1,113	6	2				
113	Less : Depreciation . . . . .	113	6	2				
1,113						1,000	0	0
14,839								
716	By Sundry DEBTORS . . . . .	596	14	1				
56	By Expenditure on Account of 1900 and 1901 . . .	25	10	6				
172	By CASH IN HAND, December 31, 1899—							
871	Secretary, Consulting Chemist, and Superintendent	113	15	7				
	Cash at Bankers . . . . .	577	5	6				
1,815						1,313	14	5
970	Less : Sundry CREDITORS . . . . .	544	1	10				
97	Less : Subscriptions received in 1899, but belonging to 1900, and carried forward . . . . .	71	0	0				
42	Less : Net Receipts in connection with York Meeting, 1900 . . . . .	432	7	2				
1,109						1,047	9	0
706								
						286	5	8
	[Memorandum.—The above Assets are exclusive of the value of the stock of Journals, Pamphlets, and Diagrams; and also of 313L, the amount recoverable in respect of arrears of Subscriptions to December 31, 1899.]							
£45,807						£37,418	15	7

Examined, audited, and found correct, this 19th day of March, 1900.

A. H. JOHNSON  
HENRY GRINLING } Auditors on behalf of the Society.  
JONAS M. WEBB }

## (A) STATEMENT OF ORDINARY INCOME

Corresponding  
figures  
for 1898

## Income.

£		£	s	d	p	¢
	<b>ANNUAL SUBSCRIPTIONS:—</b>					
391	<i>Governors</i> : Subscriptions for 1898 . . . . .	356	0	0		
110	<i>Members</i> : Received in 1898, but belonging to 1899 . . . . .	97	0	0		
6,846	Subscriptions for 1899 . . . . .	6,590	15	0		
64	Subscriptions for previous years. . . . .	56	0	0		
63						7,043 15 0

## LIFE COMPOSITIONS:—

	Contribution to Revenue (See Balance Sheet)—					
2,917	3,855 Life Members at 15s. each . . . . .					57,825 0 0

£10,391

£10,391

correspond-  
g figures  
of 1898

## Expenditure.

### GENERAL ADMINISTRATION:—

	£	s.	d.	£	s.	d.
Proportion of Salaries of Official Staff (including Temporary Assistance)	2,441	12	6			
Pensions to Officials	340	0	0			
Professional Charges	72	19	6			
Grant to Mansion House Association on Railway and Canal Traffic	10	10	0			
House Rent, Taxes, Insurance, and House Expenses	1,780	10	8			
Binding and Purchase of Books	21	18	2			
Printing and Stationery	322	8	9			
Postage and Telegrams	119	5	8			
Carriage of Parcels, and Cabs	12	12	5			
Advertising and Miscellaneous Office Expenses	54	14	9			
				5,176	12	5

### JOURNAL OF SOCIETY AND OTHER PUBLICATIONS:—

Printers' Bills for the four numbers of 1899	1,281	14	7			
Wood Engravings and Illustrations	134	17	9			
Editor and Literary Contributions	802	19	0			
Postage, Packing, and Delivery	642	8	8			
Miscellaneous Journal Printing	40	12	0			
Miscellaneous Journal Expenses	21	11	8			
Cost of Printing Pamphlets	20	0	0			
Text Book, "Elements of Agriculture"	10	10	0			
	2,951	8	3			
Less: Received from Sales of Journal	£168	8	0			
Advertisements in Journal	402	9	10			
Sales of Pamphlets and Diagrams	47	1	1			
Sales of Text Book on Agriculture	80	1	6			
	693	0	5			
Printing List of Members				2,258	7	10
				112	14	0

### LABORATORY:—

Salaries, Wages, &c.	1,100	0	0			
Printing, and Sundry Expenses	39	11	6			
	1,139	11	6			
Less: Fees received from Members for Analyses	488	4	6			
	651	7	0			

### OTHER SCIENTIFIC DEPARTMENTS:—

Consulting Botanist's Salary	250	0	0			
Zoologist's Salary	200	0	0			
Grant to Royal Veterinary College	500	0	0			
Ditto Tuberculosis Inquiry	200	0	0			
Medals for Proficiency in Cattle Pathology	2	14	0			
Printing	29	2	11			
Expenses of Grass Experiments	40	14	4			
	1,222	11	3			

### EXAMINATION IN THE SCIENCE AND PRACTICE OF AGRICULTURE:—

Medals	25	10	0			
Five Life Memberships at 15l. each	75	0	0			
Fees to Examiners	131	5	0			
Advertising Examination	7	12	0			
Printing, &c.	41	14	10			
Hire of Hall for Examination	15	0	0			
	298	1	10			
Less: Deposits forfeited	17	0	0			
	279	1	10			

### EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING:—

Hire of Premises and Appliances for Examination	43	15	0			
Fees to Examiners	44	13	3			
Hotel and Travelling Expenses	20	17	7			
Printing	2	15	10			
Advertising Examination	10	10	6			
	122	12	2			
Less: Deposits forfeited	4	0	0			
	118	12	2			

Total Expenditure	9,819	6	6			
Balance carried to Balance Sheet	171	13	6			
	£9,991	0	0			

Examined, audited, and found correct, this 19th day of March, 1900.

A. H. JOHNSON

HENRY GRINLING

Auditors on behalf of the Society.

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Corresponding  
figures  
for 1898

£2,645

## Receipts.

## SUBSCRIPTIONS:-

From Maidstone Local Committee . . . . .

£ 1 1 2      £ 1 1 2

1,998 0 0

## FEES FOR ENTRY OF IMPLEMENTS:-

5,935	Implement Exhibitors' Payments for Shedding . . . . .	4,370 11 0	
257	Non-Members' Fees for Entry of Implements . . . . .	183 0 0	
80	Fees for Entry of "New Implements". . . . .	53 0 0	
6,272			4,506 11 0

## FEES FOR ENTRY OF LIVE STOCK:-

871	By Members:-1,536 Entries @ 10s. . . . .	768 0 0	
118	91 Post Entries @ 15s. . . . .	68 5 0	
62	57 Late " @ 11s. . . . .	37 0 0	
11	40 Substituted Entries @ 5s. . . . .	10 0 0	
247	By Non-Members:-182 Entries @ 11s. . . . .	182 0 0	
103	17 Post Entries @ 30s. . . . .	25 10 0	
66	12 Late " @ 21s. . . . .	24 0 0	
1	4 Substituted Entries @ 10s. . . . .	2 0 0	
462	Fees for Horse Boxes and Stalls . . . . .	511 10 0	
1,941			1,928 10 0

## FEES FOR ENTRY OF POULTRY:-

24	By Members:-140 Entries @ 2s. 6d. . . . .	17 10 0	
4	10 Post Entries @ 5s. . . . .	2 10 0	
170	By Non-members:-457 Entries @ 5s. . . . .	114 5 0	
4	18 Post Entries @ 10s. . . . .	8 0 0	
5	34 Entries of Table Poultry . . . . .	3 0 0	
207			145 5 0

## OTHER ENTRY FEES:-

106	Fees for Entry of Produce . . . . .	73 7 6	
19	Fees for Entries in Horse-shoeing Competition. . . . .	15 11 0	
42			

## CATALOGUE:-

16	Extra Lines for particulars of Implement Exhibits . . . . .	26 7 6	
7	Woodcuts of New Implements. . . . .	9 10 0	
295	Advertisements in Catalogue . . . . .	195 0 9	
318			220 10 5
46 {	Sales of Implement Section of Catalogues (including bound copies). . . . .	33 16 0	
630	Sales of Combined Catalogue . . . . .	302 14 0	
31	" " " (bound copies) @ 2s. 6d. . . . .	23 10 0	
17	Catalogues sold after Show, &c. . . . .	10 16 6	
725		370 16 6	
59	Less Commission on Sales in Showyard . . . . .	43 6 0	
666			327 10 6

## MISCELLANEOUS RECEIPTS:-

136	Fines for Non-Exhibition of Live Stock, &c. . . . .	12 3 0	
£12,353	Carried forward . . . . .		£2,702 12 6

respond-  
g figures  
or 1898

## Expenditure.

### COST OF ERECTION OF SHOWYARD:—

		£	s.	d.	£	s.	d.
£7,950	Timber . . . . .	6,077	2	4			
123	Ironmongery . . . . .	108	8	7			
64	Paints, Oil, Glass, Lead, &c. . . . .	68	2	11			
44	Bricks, Lime, Cement, and Coal . . . . .	47	14	0			
1,664	Canvas, Roofing Cloth, Felt, Balze, &c. . . . .	1,293	10	9			
833	Railway Charges, 814l. 10s. 7d.; Horse Hire, 153l. 3s. 6d. . . . .	967	14	1			
41	Insurance . . . . .	45	11	8			
44	Stationery, Postage, and Telegrams . . . . .	67	5	6			
6	Hire of Furniture, &c. . . . .	2	8	0			
3,330	Wages . . . . .	3,261	18	9			
500	Superintendent and Consulting Surveyor : Salaries and Expenses . . . . .	654	16	6			
<b>COST OF WATER PIPING :</b>							
173	Proportion of original cost of Water Pipes, &c. (865l. 16s. 8d.), debited to Maidstone Meeting . . . . .	138	10	7			
551	Cost of Labour and Superintendence in laying down and taking up pipes . . . . .	314	12	10			
15,323		13,047	18	6			
<b>Less :—</b>							
4,260	Sale of Materials . . . . .	23,651	18	6			
1,687	Work for Exhibitors and Purveyors . . . . .	1,489	4	5			

### EXPENSES AT HEAD OFFICE IN LONDON:—

17	Expenses of Inspection Committee . . . . .	45	9	1		
702	Assistant Director's Salary and Proportion of Salaries of Ordinary Clerical Staff debited to Show Account . . . . .	1,071	0	0		
8	Assistant Director's Journeys to Maidstone and Expenses . . . . .	12	12	11		
164	Extra Clerical Assistance . . . . .	74	4	9		
					1,203	6 9

### PRINTING:—

517	Printing of Prize Sheets, Certificates, Admission Orders, Parchment Numbers, Circulars to Exhibitors, Prize Cards, Members' Tickets, and Miscellaneous . . . . .	448	14	2
5	Secretary's Local Printing . . . . .	1	9	0
71	Programmes for Members . . . . .	49	18	10
55	Plans of Showyard . . . . .	37	6	6
725	Printing of Catalogues . . . . .	524	14	4
52	Binding of Catalogues . . . . .	27	3	6
8	Carriage of Catalogues to Showyard . . . . .	14	5	10
57	Printing Awards . . . . .	61	1	2
		<hr/>		
		1,174 13 4		

### ADVERTISING, BILL POSTING AND PLACARDING:—

836	Advertising Show, Closing of Entries, &c., in Newspapers . . . . .	708	13	5		
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### POSTAGE, CARRIAGE, &c.:—

154	General Postage, &c., 88l. 14s. 6d.; Postage of Tickets to Members, 86l. 15s. 5d. . . . .	125	9	11		
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### AMOUNT OF PRIZES AWARDED (for details see page xx) . . . . .

5,132		4,791	9	0		
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### COST OF FORAGE FOR LIVE STOCK:—

713	Hay, 152l. 16s. 3d.; Straw, 343l. 1s. 4d.; Green Food, 158l. 10s. 0d.; Miscellaneous Expenses, 20l. 1s. 6d. . . . .	674	9	1		
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£18,593	Carried forward . . . . .	£16,585	0	1		
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Corresponding  
figures for  
1896

## Receipts (contd.)

		£	s.	d.	£	s.	d.
£12,353	Brought forward . . . . .				3,080	12	5
271	Amounts received from Refreshment Contractors . . . . .				35	6	0
52	Premium for Cloak Room, &c. . . . .				52	0	0
	<b>ADMISSIONS TO SHOWYARD:—</b>						
32	Saturday, June 17, @ 2s. 6d. . . . .	22	2	6			
613	Monday, June 19, @ 5s. . . . .	262	15	0			
1,312	Tuesday, June 20, @ 2s. 6d. . . . .	1,117	11	0			
2,789	Wednesday, June 21, @ 2s. 6d. . . . .	1,064	1	0			
2,446	Thursday, June 22, @ 1s. . . . .	1,628	19	10			
687	Friday, June 23, @ 1s. . . . .	639	8	3			
86	Day Tickets . . . . .	206	3	9			
157	Season Tickets . . . . .	96	13	6			
8,122					6,285	11	19
	<b>ENTRANCES TO HORSE RING:—</b>						
19	Monday, June 19 . . . . .	24	11	0			
213	Tuesday, June 20 . . . . .	214	11	0			
349	Wednesday, June 21 . . . . .	101	4	0			
118	Thursday, June 22 . . . . .	113	9	0			
24	Friday, June 23 . . . . .	21	13	0			
7-3					473	5	0
	<b>DAIRY:—</b>						
20	Receipts at Stand at Dairy . . . . .	10	7	3			
51	Sales of Produce at Dairy . . . . .	54	9	3			
4	Receipts at Stand at Poultry Shed . . . . .	3	8	3			
75					70	4	11
	<b>PRIZES AWARDED:—</b>						
3,976	Horses, 1,679s.; Cattle, 1,746s. . . . .	3,418	0	0			
1,603	Sheep, 1,885s. 10s.; Pigs, 345s. . . . .	1,780	10	0			
249	Poultry . . . . .	244	15	0			
167	Cheese, 90s.; Butter, 94s. . . . .	184	0	0			
40	Cider and Perry . . . . .	40	0	0			
—	Hops . . . . .	210	0	0			
—	Preserved Fruits, &c. . . . .	13	0	0			
32	Horse-shoeing . . . . .	32	0	0			
250	Implements . . . . .	100	0	0			
5	Silver Medals for New Implements . . . . .	6	4	0			
40	Contribution to Bee Department . . . . .	40	0	0			
6,372		6,018	9	0			
1,145	Lees:—						
96	Prizes given by Local Committee . . . . .	£1,110	0	0			
	" " Various Societies . . . . .	117	0	0			
1,241		1,227	0	0			
5,131		£4,791	9	0			
1,568	Balance to Debit of Maidstone Meeting . . . . .						
£23,165							

ERNEST CLARK, Secretary.  
WELTON, JONES & CO., Accountants.

EXPENDITURE AT THE MAIDSTONE MEETING, 1899 (*continued*).

xxi

Expenditure ( <i>contd.</i> )		£ s. d.	£ s. d.
£18,593	Brought forward . . . . .		16,585 0 1
<b>JUDGES' FEES AND EXPENSES:—</b>			
862	Judges of Miscellaneous Implements, 28l. 16s. 8d.; Ditto for Lodgings, 12l. . . . .	40 18 8	
	Judges of Hop Washers . . . . .	22 19 4	
	Judges of Cream Separators . . . . .	44 0 0	
	Judges of Horses, 170l. 15s. 6d.; Cattle, 187l. 5s. 6d.; Sheep, 215l. 6s. 6d.; Pigs, 49l. 7s. 8d.; Poultry, 34l. 17s. 8d.; Butter, 18l. 3s. 4d.; Cheese, 16l. 11s.; Cider and Perry, 15l. 2s. 8d.; Hops, 15l.; Horse-shoeing, 40l. 11s.; Ditto for Lodgings, 15l.; Preserved Fruits, 9l. 18s. 6d. . . . .	784 19 3	
	Badges for Judges and other Officials . . . . .		£92 16 3
32	Rosettes . . . . .		38 11 0
34			30 2 3
<b>EXPENSES OF ADMINISTRATION:—</b>			
214	<i>Stewards:—</i> Housekeeping Expenses, 135l. 4s. 9d.; Personal and Railway Expenses, 39l. 12s. 5d.; House, 100l. . . . .	274 17 0	
139	<i>Assistant Stewards:—</i> Honoraria, 88l.; Railway Expenses, 32l. 16s. 4d.; Lodgings, 53l. . . . .	173 16 4	
100	<i>Official Staff:—</i> Houses, 36l. 16s.; Maintenance of Clerks, 48l. 15s. 1d.; Travelling Expenses, &c., 13l. 11s. 1d. . . . .	99 2 2	
107	<i>Finance Office:—</i> Superintendent of Turnstiles, 20l. 7s.; Money Takers, 53l. 3s. 6d.; Bank Clerks, 17l. . . . .	90 10 6	
40	<i>Awards Office:—</i> Clerks, 34l. 4s. 3d.; Award Boys, 14l. 2s. . . . .	48 6 2	
599			686 12 2
<b>General Management:—</b>			
160	Foreman and Assistant Foremen . . . . .	177 6 3	
431	Yardmen, Grooms, and Foddermen . . . . .	382 14 2	
88	Door and Gate Keepers . . . . .	73 17 6	
171	Carriage Hire, 95l. 4s.; Horse Hire, 118l. 9s. 9d. . . . .	213 13 9	
849			847 11 8
121	<i>Veterinary Department:—</i> Veterinary Inspectors, 126l. 12s. 6d.; Lodgings, 7l. 10s.; Field for Examination, 3l.; Gratuities, 1l. . . . .	138 2 6	
177	<i>Engineering Department:—</i> Consulting Engineer and Assistants, 218l. 6s. 11d.; Carriage, 8l. 7s. 6d.; Repairs and Maintenance of Machinery, 45l. 8s.; Wages to Workmen, 22l. 14s. 6d. . . . .	286 13 10	
800	<i>Police, &amp;c.:—</i> Metropolitan Police, 601l. 10s. 4d.; Commissionaires, 38l. 2s. . . . .	636 12 4	
1,098			1,061 8 8
251	<i>Dairy:—</i> Milk, 72l. 3s. 9d.; Ice, 30l. 2s. 6d.; Dairy Staff, 152l. 3s. 9d.; Salt, 18s.; Utensils, 37l. 4s. 9d.; Coal, 3l. 17s. 6d.; Carriage, 17l. 12s. 8d. . . . .		304 2 6
16	Expenses of Analyzing Milk of Dairy Cows . . . . .		13 16 3
84	<i>Poultry:—</i> Penning, Attendants and Food, 16l. 14s. 6d.; Poultry Demonstrations, 82l. 12s. 4d.; Purchase of Dead Poultry, 8l. 2s.; Carriage of Poultry to and from Showyard, 4l. 19s. 9d. . . . .		62 8 7
39	<i>Horse-shoeing:—</i> Hire of Forges, 13l. 7s. 6d.; Coal, 2l. 12s. 8d.; Ironmongery, 14s. 1d.; Wages and Gratuities, 5l. 10s. . . . .		22 4 3
<b>GENERAL SHOWYARD EXPENSES:—</b>			
368	Hire of Furniture, Canvas, &c., 163l. 7s. 10d.; Hire of Chairs, 40l. 1s. 6d.; Tan, 15l. 14s. 4d.; Telegraph Extension, 17l. 9s. 5d.; Newspapers, 1l. 4s. 7d.; Ironmongery, 12l. 4s. 9d.; Tumbler Cart, 25l. . . . .	275 2 5	
90	Band . . . . .	112 0 0	
50	St. John Ambulance Association . . . . .	50 0 0	
30	Royal and Official Luncheons . . . . .	87 19 8	
12	Gratuities to Bath Chairmen . . . . .	12 0 0	
15	Miscellaneous Payments: Secretary, 3l. 3s. 6d.; Superintendent, 42l. 3s. 9d. . . . .	45 7 3	
565			589 8 11
143	<b>EXPENSES OF TRIALS . . . . .</b>		5 17 4
£23,165	<b>Total Expenditure . . . . .</b>		<b>£21,182 18 11</b>

Examined, audited, and found correct, this 2nd day of December, 1899.

A. H. JOHNSON, } Auditors on behalf of the Society.  
 JONAS M. WEBB, }

TABLE SHOWING THE NUMBER OF GOVERNORS AND MEMBERS  
IN EACH YEAR FROM THE ESTABLISHMENT OF THE SOCIETY.

Year ending with Show of	President of the Year	Governors		Members			Total
		Life	Annual	Life	Annual	Honorary	
1839	8rd Earl Spencer	—	—	—	—	—	1,100
1840	5th Duke of Richmond	86	189	146	2,434	5	2,869
1841	Mr. Philip Pusey	91	219	231	4,047	7	4,595
1842	Mr. Henry Handley	101	211	328	5,194	15	5,849
1843	4th Earl of Hardwicke	94	209	429	6,155	15	6,902
1844	8rd Earl Spencer	95	214	442	6,161	15	6,927
1845	5th Duke of Richmond	94	198	527	5,899	15	6,733
1846	1st Viscount Portman	92	201	554	6,105	19	6,971
1847	6th Earl of Egmont	91	195	607	5,478	20	6,891
1848	2nd Earl of Yarborough	93	186	648	5,887	21	6,835
1849	8rd Earl of Chichester	89	178	582	4,648	20	5,512
1850	4th Marquis of Downshire	90	169	627	4,856	19	5,361
1851	5th Duke of Richmond	91	162	674	4,175	19	5,121
1852	2nd Earl of Ducie	93	156	711	4,002	19	4,981
1853	2nd Lord Ashburton	90	147	739	8,928	19	4,923
1854	Mr. Philip Pusey	88	146	771	4,152	20	5,177
1855	Mr. William Miles, M.P.	89	141	795	8,838	19	4,882
1856	1st Viscount Portman	85	139	839	8,896	20	4,979
1857	Viscount Ossington	83	137	896	8,988	19	5,068
1858	6th Lord Berners	81	133	904	4,010	18	5,146
1859	7th Duke of Marlborough	78	130	927	4,008	18	5,161
1860	5th Lord Walsingham	72	119	927	4,047	18	5,183
1861	4th Earl of Powis	84	90	1,118	8,328	18	4,633
1862	{ H.R.H. The Prince Consort 1st Viscount Portman }	83	97	1,151	3,475	17	4,823
1863	Viscount Eversley	80	88	1,263	8,735	17	5,183
1864	2nd Lord Feversham	78	45	1,343	4,013	17	5,496
1865	Sir E. C. Kerrison, Bart., M.P.	79	81	1,386	4,190	16	5,762
1866	1st Lord Tredegar	79	84	1,395	4,049	15	5,622
1867	Mr. H. S. Thompson	77	82	1,388	3,903	15	5,465
1868	6th Duke of Richmond	75	74	1,409	3,888	15	5,461
1869	H.R.H. Prince of Wales	75	73	1,417	3,864	17	5,446
1870	7th Duke of Devonshire	74	74	1,511	3,764	15	5,488
1871	6th Lord Vernon	72	74	1,539	3,896	17	5,448
1872	Sir W. W. Wynn, Bart., M.P.	71	73	1,655	3,953	14	5,766
1873	3rd Earl Cathcart	74	62	1,332	3,986	12	5,916
1874	Mr. Edward Holland	76	58	1,944	3,756	12	5,846
1875	Viscount Bridport	79	79	2,058	3,918	11	6,145
1876	2nd Lord Chesham	83	78	2,164	4,018	11	6,249
1877	Lord Skelmersdale	81	76	2,239	4,073	17	6,486
1878	Col. Kingscote, C.B., M.P.	81	72	2,328	4,180	26	6,687
1879	H.R.H. The Prince of Wales, K.G.	81	72	2,453	4,700	26	7,352
1880	9th Duke of Bedford	83	70	2,673	5,083	20	7,929
1881	Mr. William Wells	85	69	2,765	5,041	19	7,979
1882	Mr. John Dent Dent	82	71	2,849	5,059	19	8,089
1883	8th Duke of Richmond & Gordon	78	71	2,979	4,952	19	8,099
1884	Sir Brandreth Gibbs	72	72	3,203	5,408	21	8,776
1885	Sir M. Lopea, Bart., M.P.	71	69	3,356	5,619	20	9,185
1886	H.R.H. The Prince of Wales, K.G.	70	61	3,414	5,569	20	9,184
1887	Lord Egerton of Tatton	71	64	3,440	5,387	20	8,962
1888	Sir M. W. Ridley, Bart., M.P.	66	56	3,521	5,225	16	8,884
1889	HER MAJESTY THE QUEEN	73	58	3,567	7,153	15	10,866
1890	Lord Moreton	122	58	3,846	6,941	17	10,984
1891	2nd Earl of Ravensworth	117	60	3,811	6,921	19	10,928
1892	Earl of Feversham	111	69	3,784	7,066	20	11,050
1893	Duke of Westminster, K.G.	107	74	3,786	7,138	21	11,126
1894	8th Duke of Devonshire, K.G.	113	73	3,798	7,212	22	11,218
1895	Sir J. H. Thorold, Bart.	120	80	3,747	7,179	23	11,149
1896	Sir Walter Gilbey, Bart.	126	83	3,695	7,253	23	11,180
1897	H.R.H. The Duke of York, K.G.	126	83	3,705	7,285	24	11,223
1898	Earl Spencer, K.G.	121	79	3,687	7,182	25	11,094
1899	Earl of Coventry	116	75	3,656	7,090	23	10,879
1900 (Mar.)	{ H.R.H. The Prince of Wales, K.G. }	111	74	3,647	6,871	24	10,727

# ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

## Proceedings of the Council.

WEDNESDAY, FEBRUARY 7, 1900.

H.R.H. THE PRINCE OF WALES, K.G. (PRESIDENT), IN THE CHAIR.

### Present:

*Trustees.*—Earl Egerton of Tatton, Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., Earl Spencer, K.G.

*Vice - Presidents.*—The Duke of Bedford, the Earl of Coventry, Lord Moreton, Sir Jacob Wilson.

*Other Members of Council.*—Mr. R. C. Assheton, Viscount Baring, Mr. J. Bowen-Jones, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Colonel Curtis Hayward, Mr. A. E. W. Darby, Mr. J. Marshall Dugdale, Mr. W. Frankish, the Marquis of Granby, Mr. R. Neville Grenville, Mr. James Hornsby, Captain W. S. B. Levett, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. P. A. Muntz, M.P., the Hon. Cecil T. Parker, Mr. A. E. Pease, M.P., Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. C. C. Rogers, Mr. S. Rowlandson, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Alfred J. Smith, Mr. Henry Smith, Mr. Richard Stratton, Mr. Martin J. Sutton, Mr. E. V. V. Wheeler, Mr. J. C. Williams, Mr. C. W. Wilson.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, C.B.; Professor McFadyean.

The following members of the York Local Committee were also present:—The Lord Mayor of York (Mr. Alderman G. Sykes Rymer), the Sheriff of York (Mr. Arthur Jones), Mr. Alderman McKay, Mr. W. H. Andrew, and Mr. Francis E. Walker.

Apologies for non-attendance were received from H.R.H. Prince Christian, K.G., Lord Brougham and Vaux, Sir John Thorold, Bart., Mr. J. H. Arkwright, Mr. Alfred Ashworth, Mr. George Blake, Mr. Victor C. W. Cavendish, M.P., Mr. H. Chandos-Pole-Gell, Mr. C. S. Mainwaring, Mr. Dan Pid. eon, Mr. E. W. Stanyforth, Mr. J. P. Terry, Mr. R. A. Warren, and Mr. Charles Whitehead.

### The late Duke of Westminster.

The minutes of the last monthly Council held on December 6, 1899, having been approved,

H.R.H. THE PRESIDENT said:—

My Lords and Gentlemen,

Before entering upon the ordinary business of the day, it is my melancholy duty, as your President, to announce, in accordance with custom, that there is a vacancy upon the Council caused by the lamented death, since our last meeting of our friend and colleague the Duke of Westminster.

It was at the Council and General Meetings of our Society, held in this room in December, that the Duke made his last public appearances before his fatal illness; and it was with a shock of deep and poignant

regret that everyone who had the privilege of being associated with him in public work learnt on the morning of December 23 that he was no more.

This is not the occasion to speak of the Duke's nobility of character, or of the many works of philanthropy and efforts for the moral and material improvement of the people in which he took so prominent a part. Amongst the very numerous public institutions that will miss his wise counsels, and the support of his name and influence, is the Royal Agricultural Society, whose President he was in 1893, when he brought to a triumphant issue the meeting held in the historic city of Chester, from which I derive one of the proudest of my titles.

Nor can we ever forget that it was due to the prompt and public-spirited action of the Duke and Sir Walter Gilbey that we owe our possession of the house where we are now assembled, and which provides accommodation worthy of the Society for the numerous departments of its public work.

I am confident that I express the feelings of every member of the Council in saying that we mourn the loss of the Duke of Westminster as that of a personal friend, a large-hearted philanthropist, and a noble-minded Englishman.

### Election of New Members.

The election of the following forty-three members was then proceeded with:—

ADAM, John B...Luddick, Newcastle-on-Tyne.  
 ANGELL, Charles R...Thong House, Gravesend.  
 ASHTON, Miss Julia...Bowdon Hall, Chapel-en-le-Frith.  
 BRIDGEMAN, Wm. C...Leigh Manor, Minsterley, Salop.  
 CARTER, Reginald...53 Campden Hill Road, Kensington, W.  
 COLMAN, Rev. F. S...The Rectory, Barwick-in-Elmet, Leeds.  
 CREWE, Hugo H...Spring Hill, East Cowes, Isle of Wight.  
 CROOKSHANK, Professor E. M...Saint Hill, East Grinstead.  
 DRIFFIELD, Thos. N...Brafferton Manor, Helperby, Yorks.  
 EVK, H. Trustram...2 St. Paul's Square, Bedford.  
 FOX, Arthur E. W...Eunox Lodge, Hinton Charterhouse, Bath.

GALE, Wm. C...Abberton House, near Colchester.  
 HALAHAN, Samuel C...Leigh Manor, Cuckfield, Sussex.  
 HANNON, P. J...Clifton House, Loughrea, co. Galway.  
 HARRIS, Mrs...Steventon Manor, Whitchurch, Hants.  
 HESKETH, Sir Thomas G. F., Bart...Easton Neston, Towcester.  
 HETHERINGTON, Thomas...Berechurch Hall, Colchester.  
 HOLLIDAY, Thomas G...Whit Rig, Hutton-in-the-Forest, Penrith.  
 KNOX, W. J...Sebergham Castle, Dalston, Cumberland.  
 LANE, Wm. S...Greenfields, Upton-on-Severn.  
 LLOYD, H. Meuric...Glanyranell, Llanwrda, R.S.O., Carmarthenshire.  
 MARK, C. D...Estate Office, Worth Park, Crawley, Sussex.  
 MARTINEZ DE HOZ, M. A...Estancia, Chapalmal, Mardel Plata, Argentine Republic.  
 MAYOR, John J...Wharf Street, Lune Street, Preston.  
 MONTEFIORE, Mrs...Worth Park, Crawley.  
 NIXON, Wm...County Council Farm School, Basing, Basingstoke.  
 PATTINSON, Jonathan...High Waskerley, Shotley Bridge, Northumberland.  
 PEACHE, James C...Laver Marney Tower, Kelvedon.  
 REMNANT, James F...10 Norfolk Crescent, Hyde Park, W.  
 ROBINSON, Edward...Sand Hutton, York.  
 SHEFFIELD, Sir Berkeley G. D., Bart...Normanby Park, Doncaster.  
 TAYLOR, Benjamin...Oaklands, Methley, Leeds.  
 TERRY, Ernest...Tostock, Bury St. Edmunds.  
 WALKER, Edward...North Farm, Walworth, Darlington.  
 WARD, H. H...Barnett House, Wolverhampton.  
 WATSON, James B...Estate Office, Shirburn, Wallingford.  
 WHITE, Robert S., jun...Agricultural College, Uckfield.  
 WILSON, N. F...Canal Ironworks, Kendal.  
 WINGFIELD, C. R. B...Onslow, Shrewsbury.  
 WOOD, Septimus...Burton-on-Stather, Doncaster.  
 YORKE, Henry F., C.B...22 Queen Anne's Gate, S.W.

The reports of the various Standing Committees were then presented and adopted as below:—

### Finance.

Sir NIGEL KINGSCOTE reported his election as Chairman of the year. The accounts for the month ended December 31, 1899, as certified by the Society's Accountants, were laid upon the table and approved. The total receipts for that period were 269*l.* 16*s.* 6*d.*, and the expenditure was 2,739*l.* 11*s.* 10*d.* The accounts for the month ended January 31, 1900, were also submitted. The total receipts for that period were 5,610*l.* 10*s.* 3*d.*, and the expenditure

was 137*l.* 10*s.* 3*d.* Accounts amounting in all to 1,512*l.* 19*s.* 5*d.* had been passed and were recommended for payment. The quarterly statement of subscriptions, arrears, and property was laid upon the table.

### House.

Sir WALTER GILBEY reported the election of Sir Nigel Kingscote as Chairman of the year. Various accounts connected with the maintenance of the Society's House had been passed and referred to the Finance Committee for payment. The Committee did not at present think it necessary that any new Trustee for the Harewood House Debenture Stockholders or for the Sinking Fund of the Harewood House Stock should be nominated in the room of the late Duke of Westminster.

### Journal.

Mr. F. S. W. CORNWALLIS reported that Sir John Thorold had been elected Chairman of the year. Various accounts in connection with the publication of the last number of the Journal (Part IV., Vol. X., 1899) had been passed for payment. The Committee recommended that the thanks of the Society be given to Mr. Albert Pell for his note on Farm Accounts, and to Mr. E. G. Wheler for his article on "Louping Ill and the Grass Tick," both appearing in the current number of the Journal. The Index to the first ten volumes of the third series of the Journal was in course of preparation. The arrangements for the next number of the Journal had been discussed, and directions given thereon to the Editor. As to the suggestion made by Sir John Swinburne and Sir Edmund Verney at the General Meeting held last December, "That the report of the Council to the General Meetings should be circulated earlier than at present," the Committee had nothing to add to the following decision they had previously arrived at on this matter, in response to similar suggestions:

This is a question which has been fully considered by the Council upon several previous occasions. The two general meetings of the Society, to which printed reports

are presented by the Council, are held respectively on May 22 (the Anniversary General Meeting), and on the Thursday of the Smithfield week. The report of the Council to the May meeting is prepared on the first Wednesday in May, but cannot be immediately issued, owing to the necessity for including in it details of the entries of stock, poultry, produce, &c., which have been made for the ensuing Country Meeting, for which the entries do not close until May 16. In recent years the Report has been communicated as soon as it is complete to the agricultural papers, in time for publication prior to the meeting, so that members may have the opportunity of ascertaining its contents beforehand.

The December General Meeting is in a different category altogether, and any alteration of the existing system would dislocate the whole of the Society's procedure. The Report to this meeting is only prepared by the Council on the day preceding the meeting, when also the final settlement is made of the prizes for the Country Meeting of the next year, in accordance with the Standing Orders of the Society. The various announcements as to these prizes constitute a large portion of the report, and if the General Meeting were held at a date after the Smithfield week, the members who are chiefly interested in this Report would in all probability be absent.

Copies of each half-yearly report are, however, always available by 11 o'clock upon the day of the meeting for the use of those members who are desirous of perusing it in anticipation of the meeting at noon, and the Secretary has been instructed to post a copy of the Report, as soon as it is ready for issue, to any member of the Society who may express a wish to receive it.

### Chemical and Woburn.

Mr. R. NEVILLE GRENVILLE reported that Mr. E. W. Stanyforth had been elected Chairman of the year. Dr. Voelcker had reported the progress of the pot experiments at Woburn, and stated that a paper embodying the results of those experiments, since their commencement, was in course of preparation, and would appear shortly. The progress of the bullock and sheep feeding experiments at Woburn was also reported. The Committee had sanctioned Dr. Voelcker's acting on the Departmental Committee, constituted by the Board of Agriculture, to inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899.

The suggestion made by Mr. G. D. Yeoman at the General Meeting in December last, "that the Council should consider the question of the use of preservatives for keep-

ing fresh and pure milk sent from the provinces to towns," had been considered, but as the subject was being investigated by a Departmental Committee of the Local Government Board, they did not recommend any present action in the matter.

The Committee drew attention to their last Report (December, 1899) as to the increasing tendency to inferiority in the case of basic slag, in respect of both quality and fineness of grinding. Experience since then had emphasised this more fully, and had pointed out the necessity of purchasers having their consignments checked by analysis of samples. Since December 1, twenty-five samples of basic slag had been submitted in all to the Consulting Chemist, and respecting twenty-two of these detailed information had been obtained. Of the twenty-two, only seven came up to the guarantees under which they were sold, leaving fifteen deficient in one respect or another. Three were deficient as regards quality alone, four deficient in respect of fineness of grinding only, while no less than eight were inferior in both respects.<sup>1</sup>

#### Botanical and Zoological.

Mr. E. V. V. WHEELER reported his election as Chairman of the year, after a letter had been read from Mr. Whitehead, informing the Committee that, owing to the state of his health, he would be unable to attend, at any rate for the next few months, and, under the circumstances, would prefer not to be re-nominated as Chairman. The Committee desired to place on record their deep regret at the reason of Mr. Whitehead's retirement from the chair, and to express their appreciation of his valuable services as Chairman of that Committee since its commencement. The Committee had considered and given instructions in the matter of the Society's exhibit at the forthcoming Paris Exhibition, and recommended that Mr. W. H. Delano, of 117-3, Quai Valmy, Paris, should be appointed Honorary Representative of the Society at the Exhibition.

<sup>1</sup> See a special report by the Committee on this subject, printed on page 87 of this number.

#### Veterinary.

The Hon. CECIL T. PARKER reported his election as Chairman of the year. The Committee recommended that a further sum of 200*l.* be placed at the disposal of the Sub-Committee conducting the experiments of the tuberculin test. The Annual Report of the Royal Veterinary College had been submitted to the Committee, and would receive their consideration at the next meeting. The Committee had received information that the City of York had been declared to be a swine-fever infected area, and recommended that exhibitors tendering entries of pigs for the Society's York Meeting should be informed that such entries could only be provisionally accepted. The Committee had considered the detailed arrangements for the veterinary examination of horses at the York Meeting, and had given instructions for the appointment of the necessary veterinary inspectors. They had also given consideration to a suggestion made by Sir John Swinburne, "That the Council should take steps towards the eradication of horse sickness." A report of investigations on this subject would appear in the annual report of the Royal Veterinary College (see page 103). They had also considered a suggestion from Mr. Samuel Kidner, that the results of the experiments on the tuberculin test should be published in the Society's Journal. The experiments were now in progress, but the question of their publication would be considered when they had been concluded.

Professor McFadyen had presented to the Committee the following report:

**ANTHRAX.**—During the first four weeks of this year thirty outbreaks, with forty-eight animals attacked, were reported. In the same period of last year there were forty-one outbreaks, with sixty-eight animals attacked.

**GLANDERS.**—The outbreaks during the first four weeks of this year numbered seventy, and the animals attacked 123. The corresponding figures for last year were fifty-eight and ninety-five respectively.

**RABIES.**—No case of this disease has been reported since the third week of December last.

**SWINE FEVER.**—During the first four weeks of this year the number of outbreaks

reported was 142, as against 189 outbreaks during the corresponding period of 1899.

**FOOT-AND-MOUTH DISEASE.**—After more than five years of complete freedom from this disease, the country has been again invaded by it, a serious outbreak having been detected in the county of Suffolk during the past week. The first information with regard to the alleged occurrence of the disease reached the Board of Agriculture on January 29, and on investigation by the Chief Veterinary Officer to the Board it was found that eleven cattle at Fritton, about six miles from Yarmouth, were affected with the disease, and at a stage which indicated that they had probably been attacked not less than a week previous. A second outbreak, involving sixty-nine cattle, was detected on February 1, at a place about seven miles from the first; and it is stated that animals from this farm were exposed in the Norwich Market on January 27. A third outbreak, also near Yarmouth, was reported on the 5th instant. An Order of the Board of Agriculture, stopping movement of animals in a large part of Norfolk and Suffolk, was issued as soon as the first outbreak was confirmed.

**TUBERCULIN.**—The experiments with regard to tuberculin have been continued at the Royal Veterinary College, and since the last meeting of the Council six more animals have been purchased for the purpose of the inquiry. This has exhausted the special sum of 200*l.* granted to defray the cost of the investigation. In view of the results already obtained—some of them of an unexpected character—the Sub-Committee, who are supervising the experiments, think it desirable that the inquiry should be continued, and that a number of further experiments, bearing on the diagnostic and other properties of tuberculin, should be carried out.

**MISCELLANEOUS.**—The number of morbid specimens forwarded to the research laboratory for examination during the month of January was twenty-six, comprising cases of tuberculosis, glanders, anthrax, swine erysipelas, calf diptheria, &c.

The Hon. CECIL T. PARKER said, with reference to the further experiments as to tuberculin advised by the Sub-Committee, that the Veterinary Committee were unanimous in desiring that this investigation should be prosecuted, and would be glad if the Council would place in the hands of the Sub-Committee a further 200*l.* to carry on the work. He made, therefore, a formal motion for a grant of this amount.

Sir NIGEL KINGSCOTE said that, as Chairman of the Finance Committee, it was his duty to watch very carefully any proposals made for increased expenditure, especially under present circumstances. But as a member of the Sub-Committee appointed to supervise these tuberculin experiments, he felt sure that the

further grant of 200*l.* asked for was one that might properly be made in the interests of the Society. The experiments had now reached a very interesting stage, and he hoped the Council would be willing to provide funds for their continuance.

The motion was then put from the Chair, and carried *nem. dis.*

### Outbreak of Foot-and-Mouth Disease.

Mr. PELL said the Council would have heard with regret, from the report of Professor McFadyean to the Veterinary Committee, that a serious outbreak of foot-and-mouth disease had occurred in the Eastern Counties, and he wished to call the attention of the Council to the way in which the outbreak had been met by the authorities. The first outbreak, as they had heard, occurred in Suffolk among a small number of cattle, and these animals, he believed, were recovering before the nature of the disease was detected. The result was that it spread with extraordinary rapidity across two rivers to a place called Freethorpe, in Norfolk, where the farm affected by the disease was near the high road. In the second outbreak no less than sixty-nine head of cattle were affected. Since then a third outbreak had been reported, and the rapid spread of the disease from one county to another had jeopardised the interests of a very large number of agriculturists. His personal experience went back to the first outbreak of the cattle plague in this country in 1866, and he had been one of the earliest advocates of slaughter. The Board of Agriculture, he was told, were considering whether it was advisable to slaughter the animals; but while they were deliberating the disease was spreading with great rapidity, and he hoped the Council would endorse his views—that prompt measures should be taken by the Board of Agriculture immediately upon receipt of information as to outbreaks of this terrible disease.

Mr. MARTIN, as a resident in the Eastern Counties, seconded this proposal, which had his warm support. He was old enough to remember the ravages of this fearful disease in the

past, and he hoped the Government would take prompt action in the matter of stamping it out.

Earl SPENCER said that he had had a great amount of administrative experience in the matter of the suppression of foot-and-mouth disease, and an enormous number of cases had been brought officially under his notice, both in this country and in Ireland. Knowing what a lively sense Government officials had entertained of the fatal effects in the past of this dire disease, he thought the Council might have every confidence in the Board of Agriculture dealing quickly and effectually with the outbreak, and that there need be no panic about the matter. There would be no further spread of the disease if those who were locally responsible for reporting outbreaks to the chief authorities would energetically and loyally support the Board of Agriculture. There was a very considerable amount of local opposition to the closing of markets, and much still remained to be done to break through this prejudice, and to induce owners of stock to help and not hinder the Government. He should be sorry if any reflection upon the action of the Board went forth from that Council. They should endeavour to decrease and not to add to the difficulties of the responsible officials, who in any serious outbreak had to consider an enormous number of cases, which would represent a terrible loss if every animal affected were ordered to be slaughtered. He thought they should rather praise the Board of Agriculture for the action they had already taken, at the same time urging them to relax no effort to suppress the outbreak which had come upon them so suddenly.

Earl EGERTON OF TATTON agreed that it would be more satisfactory to make a recommendation as to the future action of the Board of Agriculture than to criticise the steps already taken. They should rather urge the Board to check the outbreak as early and effectually as possible by means of compulsory slaughter.

Sir JACOB WILSON said that as Mr. Pell did not appear to be in possession of the fullest and latest

information on the subject, he thought he might venture to assure the Council that when the first outbreak was notified to the Board of Agriculture, immediate action was taken and every inquiry instituted. It was found that the animals had been ill for several days before the owner or his stockman suspected that they were suffering from anything more serious than a cold. The younger generation of farmers and herdsmen had had so little experience of foot-and-mouth disease that they knew scarcely anything of the symptoms, and the animals in question had evidently gone through the various stages of the disease, and were recovering, before the real nature of their malady was suspected. All the animals affected by the second and third outbreaks had been slaughtered. The Board of Agriculture were, as it was hardly necessary to assure the Council, fully alive to the necessity of slaughter at once when the circumstances demanded it.

Mr. MUNTZ asked how long it was since they had had an outbreak of foot-and-mouth disease, and whether it had been ascertained how this particular outbreak actually occurred?

Sir GEORGE BROWN said it was as nearly as possible five years since the last outbreak in this country.

Sir JACOB WILSON was unable to state at that moment how this outbreak actually occurred, but it was the fact that foot-and-mouth disease was raging in various parts of the Continent, and thence had possibly passed to our shores.

Professor MCFADYEAN, in reply to a further question, said he did not know whether the animals in the third outbreak had been slaughtered, but there was no evidence to show that the disease had spread since it had been brought to the notice of the Board of Agriculture.

Mr. PELL said that his proposed motion was intended to strengthen the hands of the Board of Agriculture, but being quite satisfied with the discussion which had taken place on the subject, he desired, with the permission of the Council, to withdraw his motion and another as to the Veterinary Department of the

Board which he had also handed in.

The motion was then by leave withdrawn.

#### Stock Prizes.

Mr. SANDAY reported his election as Chairman of the year. The Committee recommended the acceptance, with thanks, of an offer from the Leicester Sheep Breeders' Association of a champion prize of 5*l.* for the best Leicester ram exhibited at the York Meeting, and from the Hampshire Down Sheep Breeders' Association of a champion prize of 20*l.* for the best Hampshire Down ram. They had also considered a question raised by the Cleveland Bay and the Yorkshire Coach Horse Societies, as to the inclusion of yearling colts exhibited in classes 20 and 28 among the stallions eligible to compete for champion prizes at the York Meeting; but as these classes are open to geldings as well as colts, they were unable to recommend that any action be taken by the Council. The Committee had no objection to the alteration in classes 19 and 27, sanctioned by the York Local Committee, by which these classes would be thrown open to three-year-old fillies as well as two-year-old fillies of the Cleveland Bay and Coach horse breeds. The Committee had had before them a letter from the English Kerry and Dexter Cattle Society, asking that the champion prizes which they had offered should be limited to animals registered in the English Kerry and Dexter Herd Book. As this Herd Book had not been in existence for seven years, the Committee recommended that the Kerry and Dexter Cattle Society be informed that unless their champion prizes were offered subject to the general regulations of this Society's prize-sheet, they could not be accepted by the Council.

The Committee had considered the question of the colouring of sheep, referred to them at the last meeting of the Council, and had resolved "that the excessive colouring of sheep as now practised at shows is objectionable, and that the matter be referred to the Breed Societies for consideration, with this expression of the Society's opinion."

They recommended, that after the York Meeting, for competition in the cattle classes the females of three years old and upwards should be limited to "cows in milk."

#### Prizes for "Cows in milk."

Mr. SANDAY said that it would be in the recollection of the Council that, at the November meeting, he had reported the conclusion at which the Stock Prizes Committee had arrived, that after the York Meeting of 1900 the competition in the cattle classes for female animals of three years old and upwards should be limited to "cows in milk." He had then notified that this matter would form the subject of a specific motion to be proposed at a later meeting, and he had placed upon the agenda-paper for that day a notice of the following resolution, which he now wished formally to move:

That after the York Meeting, the competition in the cattle classes for females of three years old and upwards shall be limited to cows in milk.

Mr. STRATTON having seconded the motion,

Sir JACOB WILSON wished before the motion was adopted to express disapproval of the alteration proposed. He should regret if the Council agreed to it before well considering that they were reversing the practice which had obtained at the Society's shows almost from the very beginning—viz., to encourage the exhibition of cows and heifers "in milk or in calf." It was now proposed that calving animals that were not in milk should be ineligible to compete, and this meant the exclusion of animals which would otherwise be perfectly eligible, and which would eventually be "in milk." This would be very regrettable, since some of the finest animals that had ever entered the Society's show-yards, had been exhibited in calf. He rather shrank from the prospect, for in these days it was, as a very recent instance had proved, possible to keep an animal in milk for an indefinite period, and to obtain an indefinite amount of milk from it, thereby withdrawing it from its proper functions as a breeding animal. A breeder would by the proposed resolution be enabled to

exhibit any sorry specimen of his herd which might be in milk, whereas he would be debarred from showing a high-bred heifer which happened to be a breeder. The result of the unsettled policy of the Stock Prizes Committee was to create a feeling of unrest and dissatisfaction, which induced some of the best breeders and owners of stock to keep their animals at home instead of exhibiting them at the Society's shows, and he did not blame them for doing so.

Mr. STRATTON said that he could not allow Sir Jacob Wilson's remarks to pass unchallenged. Sir Jacob said that by the terms of the motion an "in-calf" animal would not be allowed to compete at the Society's shows. This was not so at all. There was no reason why an animal should not be in milk and in calf at the same time. It had been the reproach of the Society for many years past that it had not adequately promoted the breeding of animals, but that its shows were too much on the lines of those of the Smithfield Club, and tended largely to promote the sterility of animals. The date of the Society's country meetings compelled an exhibitor to show his cows at a time of the year when they were mostly in milk; many of the animals in these classes could certainly not have calved at that time. It was a mistake to show dry cows with milking cattle in the same classes, and frequently cows and heifers were exhibited as "in-calf" which were not in calf at all. The Council were acting wisely in removing the reproach which had too long rested upon the Society, of encouraging fat stock to the injury of breeders and the proprietors of breeding stock. He was certain that many owners of the best cattle refused to show them at all, because they knew that by getting them into a condition such as would command a prize they would be sacrificing their breeding properties. The present resolution was one of the most important steps the Society had taken for a long time, and he believed it would have the effect of bringing new exhibitors into the field. He had had a great deal of experience as a judge of cows and heifers "in milk," and he could testify

that they were none the better for being fat. He hoped that in the future they would see more cows and heifers shown in natural condition. Sufficient attention had not hitherto been paid to the milking properties of cattle, and it was high time that steps in the right direction were taken. He hoped the Council would adopt the resolution which had been recommended by the Stock Prizes Committee.

The motion was then put from the Chair and carried *nem. dis.* on a show of hands.

#### Judges' Selection.

Mr. SANDAY reported that the Committee had selected the names of gentlemen to be invited to act as judges in the several departments of the York Meeting, and recommended that the invitations be issued to them forthwith, the conditions being the same as those in force at the Maidstone Meeting (see pages liii-lvi).

#### Implement.

Mr. FRANKISH reported his election as Chairman of the year. The implement regulations and prize-sheet for the York Meeting had been duly issued. The Committee had considered and settled various matters relating to the exhibition of implements, and had appointed a sub-committee to examine the entries and allot the space at the York Meeting. They had further considered the question of offering prizes for Oil Engines and Ice-making Plant at the Country Meeting of 1901, and had given instructions for the preparation of conditions and regulations for the trials to be sent out to the members of the Committee before the next meeting. They had had before them a suggestion from Sir John Swinburne "That prizes should be offered at the York Meeting for portable petroleum oil engines," but as the implement prizes for the York Meeting had been settled, it was proposed to offer such prizes in connection with the Society's Country Meeting of 1901. The Sub-Committee appointed at the December Meeting to inspect and value the Society's plant stored at Erith had reported, and had estimated the present value of the plant to be £151. 15s.

### General York.

The Earl of COVENTRY (Chairman) reported that the railway charges for the York Meeting had been fixed at the same rates as were in force at the Society's meetings at Birmingham and Maidstone, as follows :

*To be added to the ordinary York rates:—*

General traffic, machinery and agricultural implements (minimum 1s. per consignment) .	3s. 0d. per ton.
Machinery and agricultural implements hauled on their own wheels (minimum 1s. per consignment) .	2s. 0d. per ton.
Carriages, two wheels .	2s. 0d. each vehicle.
Carriages, four wheels .	3s. 0d. each vehicle.
Live stock, per waggon or horse-box .	2s. 6d. each vehicle.

*To be made in addition to the above, when the companies deliver to, or collect from, the Show-ground:—*

Boilers, machinery, forgings, and other heavy articles:—

Exceeding 5 but not exceeding 9 tons each .	2s. 0d. per ton.
Exceeding 9 but not exceeding 12 tons each .	4s. 6d. per ton.
Exceeding 12 but not exceeding 15 tons each .	7s. 0d. per ton.
Exceeding 15 tons each .	9s. 6d. per ton.
Engines and other machines on their own wheels:—	
Exceeding 5 but not exceeding 9 tons each .	2s. 6d. per ton.
Exceeding 9 but not exceeding 12 tons each .	4s. 6d. per ton.
Exceeding 12 but not exceeding 15 tons each .	6s. 6d. per ton.
Exceeding 15 tons each .	8s. 6d. per ton.

*Cattle in floats, single horse .	5s. 0d. per float.
*Cattle in floats, double horse .	7s. 6d. per float.
*Sheep or pigs loose in floats (minimum per float), 4s. .	1s. 0d. each.
Sheep or pigs in crates (large) .	2s. 0d. per crate.
Sheep or pigs in crates (small) .	1s. 3d. per crate.
Poultry, in packages .	3d. per package.
Packages of produce, butter, &c., not exceeding 7 lb. in weight .	3d. per package.
Fodder .	3s. 0d. per load.

\* Exhibitors who may require floats are particularly requested to give early intimation to this effect to the railway authorities, and to specify which description of float will be wanted; otherwise the accommodation desired cannot be guaranteed.

The Secretary had reported to the Committee an arrangement with the postal authorities at York, whereby letters intended for members of the Society, specifically addressed to the Members' Pavilion in the Showyard,

would be delivered to members calling for them at the Telegraph Office in the Pavilion. The Committee had considered various matters of detail connected with the Show, and had given instructions with regard to them.

### Showyard Works

Sir JACOB WILSON reported his election as Chairman of the year. Work had been commenced on the showyard at York, and the Local Committee had laid down the sleeper road to the goods entrance. The Committee had accepted a tender for laying the water mains in the York showyard, and had considered and decided various points connected with the forthcoming Country Meeting.

### Selection.

Mr. CRUTCHLEY reported that Sir John Thorold had been elected Chairman of the year. The Committee had considered the suggestion made at the General Meeting by Sir Edmund Verney, "That a member who makes a suggestion at the General Meeting should be invited to attend the particular committee to which his suggestion is referred." They were of opinion, however, that it was impracticable to lay down any general rule on this subject. If, in any particular case, a Committee desired further information on a matter raised by a suggestion at the General Meeting, the Committee already had the power to ask the member making the suggestion, or others capable of affording information, to meet them in conference. The Secretary had submitted a further letter from the Secretary of the National Agricultural Union, dated December 20, as to the organisation of the proposed Imperial Agricultural Congress. After careful consideration, the Committee were unable to recommend the acceptance of the invitation, which the National Agricultural Union had addressed to the Society, to appoint a representative on the Organising Committee of the proposed Congress, and they recommended that the Secretary be instructed to express the Society's regrets that it was unable to enter further into the project. A letter

had been read from the Société des Agriculteurs de France, asking if the Society was now in a position to nominate delegates to the Conference in June, at which the Council had already decided to be represented, and mentioning that the Special Conference, at which the presence of foreign delegates was particularly desired, had been fixed for Saturday, June 30. The Committee trusted that some member or members of the Council might be willing to act as the Society's representatives on that occasion. A letter had also been read from the Commission Internationale d'Agriculture, asking the Society to appoint delegates to the Official International Agricultural Congress to be held in connection with the Universal Exhibition, from July 1 to 8. The Committee were of opinion that it would be desirable that the Society should, if found practicable, be represented on this occasion also.

#### Education.

Lord MORETON reported his election as Chairman of the year. The Committee had considered and settled various details connected with the examinations both in Agriculture and Dairying to be held in the present year. The Committee were giving consideration to the question of elementary education in rural districts, as to which suggestions had been made at the General Meeting by Sir Edmund Verney and Mr. G. D. Yeoman.

Mr. SUTTON desired to ask Lord Moreton what steps the Education Committee were taking to fall into line with the present feeling in the country on the subject of the education of the rural population. He was a member of a deputation recently received by the Duke of Devonshire, who assured them that measures in this direction would shortly be taken by the Education Department. But His Grace made it quite clear that, if anything effective was to be done, the Department would require adequate support out of doors. This was a work which might very appropriately be undertaken by that Society, which eight years ago had given to the world a most valuable text-book on Agriculture, which still

held the field. This book was no doubt too advanced for the children attending elementary schools in rural districts, but he put it to the Education Committee whether it would not be possible for them to prepare and publish simple reading-books on subjects relating to Agriculture, such as the different breeds of stock, farm implements, natural science, and the like. He thought that by interesting, and at the same time educating, country children in the farm life around them, something would be done to check the stream of migration from rural districts to large towns, which every year made it increasingly difficult for farmers to gather in their harvest, owing to scarcity of labour.

Lord MORETON thought that the Council would agree that in the past the Education Committee had not been behindhand in doing what they could for agricultural education, and one of their most useful acts had undoubtedly been the publication of the text-book referred to by Mr. Sutton. The present demand appeared to be for agricultural education in elementary rural schools, and he undertook, on behalf of the Education Committee, that they would go thoroughly into the whole question raised by Mr. Sutton.

#### Dairy.

Mr. DUNDALE reported his election as Chairman of the year. The Committee had considered and given instructions upon various matters in connection with the dairy at the York Meeting. They had also considered a suggestion made by Mr. Christopher Middleton at the General Meeting held on December 7 last, "That more attention should be paid to the dairy cattle classes in the prize-sheet." This was a matter that had been already under the consideration, and was still receiving the attention, of the Committee.

#### Special Show Committee.

The Hon. CECIL T. PARKER (Chairman) said that it might be in the recollection of the Council that, at the December meeting, he mentioned that the Special Committee as to the Society's show system had made a certain amount of progress in the

consideration of the questions remitted to it by the Council, and that it hoped to be in a position to submit a report in February. That promise he was now able to fulfil by the presentation of the Report which he laid upon the table. It would obviously be impossible for the Council to discuss a report of such length and complexity without adequate time for consideration; and all, therefore, that he proposed on that occasion to do was to ask the Council to receive it, and allow it to be printed and distributed as a public document for general circulation, with a view to its consideration at the March meeting of the Council. He suggested that with this object a special meeting of the Council should be convened for 11 A.M. on the customary day of meeting, Wednesday, March 7, the ordinary meeting of the Council being held as usual at noon on that day. If this course should be approved, it would doubtless be better that all discussion on the Report should be reserved until that occasion; and he would therefore confine himself then to a statement of facts with regard to the work of the Committee.

Upon its appointment at the end of July, he entered into correspondence with the members, inviting suggestions, and at the Committee's first meeting, on October 30, he laid upon the table a memorandum which he had prepared during the recess, embodying his own views. He was gratified and, he might add, considering their character, agreeably surprised that his somewhat far-reaching proposals had met with such general acceptance. The Committee adjourned after its first meeting for a month, to enable the three additional members, whom it had instructed to elect, to consider his memorandum; and in December the whole subject was discussed in a very full Committee. From the points raised in that discussion the Report now presented to the Council had been constructed, and he desired to tender to his colleagues his personal thanks for the care and attention that they bestowed on the revision of his draft. The Committee sat for over three hours on the previous

Monday revising the draft, and every member of the Committee had contributed some valuable suggestions for its improvement.

Much of what appeared in the Report would no doubt be familiar to the Council, but as it was a document intended for the information of the members and the public generally, the Committee had thought it right to go into some detail as to the organisation of the Shows. The essence, however, of the recommendations of the Committee was that they felt that they could not take the responsibility of advising the Council to commit the Society to the holding of another series of Shows on the basis of the existing rotation, which would involve the shifting of the Show from one district of England to another for the next nine or ten years; and that the Committee had arrived at the conclusion that if the Society's shows were to fulfil their proper function in the future, without an unwarrantable drain upon the Society's general resources, it would be desirable that if possible they should be held upon a permanent location near some large town (preferably in the centre of England), which would be convenient for railway access from all parts of the country. In fact, the endeavour of the Society in the future should be to bring the people to the Show, and not the Show to the people.

It was right to add that, although the Report had been signed by all ten members of the Committee, Sir Jacob Wilson had added a reservation that he was not satisfied (as the other members of the Committee were) that every alternative to a permanent showyard in one single place had been exhausted. Sir Jacob was "of opinion that by various re-arrangements the size of the showyard could be appreciably diminished; and that by varying the composition of the prize-sheet, according to the wants and circumstances of each district visited, the annual expenditure for prizes, and for the preparations consequent thereon, could be much decreased." This reservation by Sir Jacob Wilson would, of course, appear in the Report as printed.

With these preliminary observations,

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he (Mr. Parker) desired to formally move that the Committee's Report be printed and circulated,\* and that a special meeting of the Council be held at 11 A.M. on Wednesday, March 7, to consider it.

Sir NIGEL KINGSCOTE seconded the motion, which was carried unanimously.

### Country Meeting of 1901.

The SECRETARY laid upon the table the draft agreement with the Corporation of Cardiff for the holding of the Country Meeting of 1901, which he had that morning received back from the Town Clerk, with various suggested amendments to its terms.

Mr. SANDAY said that as he had been concerned in the negotiations with regard to this matter, the suggested amendments had been referred to him for perusal. The wording of certain of the clauses would again have to be revised before the agreement could be presented to the Council for final approval. It would, he thought, be sufficient if authority were given to the Secretary to conduct such negotiations with the Town Clerk as might be necessary for the adjustment of the few points at present outstanding.

A formal motion to this effect, proposed by Mr. SANDAY and seconded by Mr. CRUTCHLEY, was passed by the Council.

### International Live-Stock Exhibition at Paris.

The SECRETARY said that although no official notification had been received on the subject, it might interest the Council to know that by a Decree of the French Minister of Agriculture, dated January 19, the date of the International Show of cattle, sheep, pigs, poultry, &c., at Paris in connection with the

Universal Exhibition, had been altered from the last week in June to June 7-18. According to the *Journal d'Agriculture Pratique* this change had been made at the instance of M. de Clercq, President of the French Syndicate of Shorthorn Breeders, on the ground "that the coincidence of this show with the annual Country Meeting of the Royal Agricultural Society at York would prevent English breeders from taking part in the Paris Show, and would keep away from Paris many foreign purchasers."

As no animal exhibited at Paris by an English breeder could come back alive (the existing Government regulations requiring slaughter at the port of landing of every animal imported into Great Britain) the question of the exhibition of any animal at both shows (York and Paris) need hardly in any case be considered; and from the point of view of intending visitors, the two shows would not have "clashed," as had been erroneously stated, since under the old arrangement the York Show would have closed its doors before those of the Paris Show were opened.

The original date fixed for the Paris Show would indeed have probably been found more convenient for English breeders and visitors than the altered date now fixed, since the York Show would be open to the public from Monday, June 18, to Friday, June 22, and the Paris Show was not to have been opened to the public until noon on Saturday, June 23. Under the new arrangement the relative positions of the two shows were reversed, Paris coming before York instead of after. Both the cattle show and the subsequent horse show, the date of which—September 2-10—had not been altered, would, it was understood, be held at Vincennes.

Various letters and other documents having been laid upon the table, the Council adjourned until Wednesday, March 7, 1900.

\* For the text of the Report of the Special Committee, see pages 85 to 86 of this number.

## Special Council.

WEDNESDAY, MARCH 7, 1900.

THE EARL OF COVENTRY (EX-PRESIDENT) IN THE CHAIR.

### Present:

*Trustees.*—Earl Egerton of Tatton, Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., the Duke of Richmond and Gordon, K.G., Earl Spencer, K.G., Sir John H. Thorold, Bart.

*Vice-Presidents.*—Earl Cawdor, the Earl of Feversham, Lord Moreton, Sir Jacob Wilson.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. Alfred Ashworth, Viscount Baring, Mr. George Blake, Mr. J. Bowen-Jones, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. Percy Crutchley, Lieut.-Col. Curtis-Hayward, Mr. A. E. W. Darby, the Earl of Derby, K.G., Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. Hugh Gorringe, the Marquis of Granby, Mr. R. Neville Grenville, Mr. James Hornsby, the Earl of Jersey, G.C.M.G., Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Mr. T. H. Miller, the Hon. Cecil T. Parker, Mr. Albert Pell, Mr. Frederick Reynard, Mr. C. C. Rogers, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Henry Smith, Mr. E. W. Stanyforth, Mr. Martin J. Sutton, Mr. Garrett Taylor, Mr. J. P. Terry, Mr. R. A. Warren, Mr. E. V. V. Wheeler, Mr. C. W. Wilson.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. W. Caruthers, F.R.S., Consulting Botanist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Show-yard.

Professor Sir George Brown, C.B.; Professor McFadyean.

Apologies for non-attendance were received from Lord Brougham and Vaux, Lord Middleton, Mr. R. C.

Assheton, Mr. H. Chandos-Pole-Gell, Mr. F. S. W. Cornwallis, M.P., Mr. A. E. Pease, M.P., Mr. Dan Pidgeon, Mr. J. E. Ransome, Mr. S. Rowlandson, Mr. A. J. Smith, Mr. R. Stratton, and Mr. Charles Whitehead.

### SPECIAL COUNCIL.

The Council held a Special Meeting before the ordinary Monthly business was entered upon, for the purpose of considering the Report of the Special Committee upon the Society's Show system (see pages 65 to 86).

At the commencement of the proceedings,

The SECRETARY said that he had received instructions to convey to the Council the regrets of H.R.H. the Prince of Wales at his inability to preside over their meeting that day, in view of the half-yearly meeting of the Governors of Wellington College that was being held at Marlborough House at the same time. Under such circumstances it was usual to ask the President of the previous year to take the chair.

Accordingly, on the motion of Sir JOHN THOROLD, the Earl of Coventry was called to the chair.

The SECRETARY then read the notice of the Meeting, as under:—

Notice is hereby given, in accordance with Bye-Law 27, that a Special Meeting of the Council will be held at the Society's House, 13 Hanover Square, W., at 11 A.M. on Wednesday, March 7, 1900, for the purpose of considering and, if thought fit, adopting the Report presented to the Council on February 7, 1900, by the Special Committee appointed on July 26, 1899, "to consider and report as to any modifications or alterations in the present Show system which they may consider desirable after the present Rotation is completed."

By Order of the Council,  
13 Hanover Square, ERNEST CLARKE,  
London, W., Secretary.  
February 28, 1900.

The Report, which had been previously printed and circulated, having by general consent been taken as read,

The Hon. CECIL T. PARKER, as Chairman of the Special Committee, formally moved the adoption of the report, and said that as the recommendations of the Committee had been announced by him at the last Council meeting, and the report had since been freely circulated and commented on in the public press, he need not then do more than formally move its adoption, reserving to himself the right of reply to any points which might be raised in the subsequent discussion.

The Earl of DERBY said that he had been asked to second the adoption of the report, presumably because the change which was recommended was a system which prevailed in several parts of Canada, of which he had had some years of experience, and in respect of which, therefore, it might be supposed that he knew something of the working. Before he approached that point he might, perhaps, be allowed to say that he felt as much as any one present that this was a great and momentous change in the affairs of the Society. At the very inception of the Society, when the first meeting was held many years ago, it was emphasised that the meetings should be held in different parts of the country, to show what were the best implements and breeds of stock—in a word, to enlighten the various parts of the country as to what was going on elsewhere. In those early days it was very easy to get a suitable show-yard, for the shows were much less in extent. On the other hand, the facilities for getting about to different parts of the country—especially for those who travelled third class—were then infinitely less than at the present time. A gentleman had told him that, in clearing out an office-drawer lately, he had come across a "Bradshaw" of some forty years back, in which the fares were all stated and the times of the journeys also. Roughly speaking, comparing that period with the present, the speed of trains had doubled and

the fares had decreased by about one-half. The facilities, too, which were now given by the running of excursion and special trains, at almost nominal rates, were such as to put no difficulties in the way of people travelling about the country. Circumstances, therefore, having become such as to enable visitors to travel about at little expense, they could not say that the placing of the show in any particular locality would prevent persons in any part of the country from attending it. They had only to regard the excursion trains running to all parts and to the sea coast to observe how the habit of travelling had spread amongst the people.

He did not believe that the fixing of the show in one place would be detrimental to the interests of the Royal Agricultural Society. There was an enormous convenience, which was stated admirably in the report, in having a showground where the place of everything was known beforehand; and this, in the working of the show alone, was very important. They could easily imagine the amount of work at present thrown upon the Honorary Director and the official staff in adapting the requirements of the show to different sites. It was now exceedingly difficult to obtain suitably placed sites in the neighbourhood of large towns; and when the Society had gone to country districts they had uniformly seen the receipts outpaced by the expenditure. To come to a point on which he could perhaps speak with more immediate knowledge, in the larger country of Canada there was a very great desire to promote the interests of Agriculture; and, in fact, the money which they spent upon provincial colleges, and in disseminating agricultural information, might be taken as an example by us at home. They, however, not from a desire to cut short the expenditure unduly, or to neglect any particular place, or to give preference to others, were still in favour of their shows being held in one fixed centre.

There might be local shows of which he (Lord Derby) did not know, but, speaking of those with which he came in contact, they were

almost always held either where there were buildings already, belonging to a syndicate, or on ground either owned or rented by an agricultural association; and in general the prevailing conditions were such as to permit of their shows being held on the same ground year after year without inconvenience. If they considered the amount which their Society had annually to expend—8,000*l.* in the erection of temporary buildings for a show, the whole of which had to be pulled down again, the laying out of the roads with sleepers for the heavy machinery, and the additional expense to the local committee in complying with the Society's very reasonable requirements, and for putting the ground back again as far as they could to its original state—all these were considerations which, he ventured to suggest, pointed to the necessity of adopting the principles which were contained in the Special Committee's report. He thought the Members of Council would agree that the report was a very admirable and concise summary of the considerations which governed this question. It necessarily occupied a great number of pages, but at the same time he did not think there were any paragraphs which were not essential to it.

In the county with which he was best acquainted (Lancashire) there were increasing difficulties year after year in connection with the holding of the County Show. Their difficulties with respect to securing the necessary ground for their show were becoming increasingly great; so much so, indeed, that in retiring from his presidency of that Society last year, he told his colleagues that in his opinion the time was fast approaching when the Lancashire Society would have to look out for a permanent ground. He only mentioned this as showing the sincerity of his belief in the proposals before them. They must also take into account the work now being done by the supplementary societies. These societies did a great deal of work; and as regards exhibitors of stock and exhibitors of implements, they had ample opportunity of showing all over the country—not in one place

alone—what they could do in their respective lines. It seemed to him, therefore, that the necessity for the Society's perambulating the country no longer existed. It was all-important for the well-being of the Society and for its financial credit that it should be able to balance its expenditure and receipts without depending entirely upon the chance of what a fine day might do in bringing in the necessary funds.

The Royal Agricultural Society was doing as good a work as ever it did. It was necessarily becoming more central for the dissemination of information, for which it was unrivalled throughout the world; and it seemed desirable that they should concentrate their whole efforts upon having a fixed show, and upon the work which was being done at present in that building, and which, he thought, must be done at one centre. As regards the particular place for a permanent showyard, presumably it must be somewhere in the Midlands, readily accessible to visitors by rail, with more than one line of route, and where a good water supply was obtainable, as well as fairly good accommodation, and likewise a good population, in order to enable the Society to swell its gate-money by the admissions of the large number of persons who took an interest in the shows. For these and various other reasons he ventured to second the adoption of this report. He was entirely in accord with almost every word of it; and he thought that those who had taken so much pains and trouble over it were entitled to the best thanks of the Society.

Sir JACOB WILSON asked to be allowed to make some observations as to the reasons which had led him to make a special qualification when attaching his signature to the report. In order to do that it would be necessary for him to take them back to the early history of the Society, which was established under the auspices of the fourth Duke of Richmond and the third Earl Spencer, for "the general advancement of English Agriculture." This was afterwards embodied in the Charter, from the

wording of which it was clear that the Society was intended to be perambulatory in character. Their first show was held at Oxford in 1839, and resulted in a loss of upwards of 1,100*l*. He might refer the Council to Table I. of the report, which showed the results of the various meetings, but he ventured on his own account to submit an analysis of those figures which he had prepared since the report was issued. During the first eighteen years of the existence of the Society there had been a continual loss on the shows amounting to 35,000*l*.; while the loss in sixty years was only 33,624*l*. The largest losses were in the early days of the Society, but that did not prevent its founders from persevering in the course they had adopted, and at length the sun of prosperity shone upon their undertaking. While the report, however, stated the exact amount of the deficiency, it did not state that nearly one-half of that deficiency was due to the failure of the Show at Kilburn. The three Metropolitan Shows at Battersea, Kilburn, and Windsor had indeed involved the Society in a loss of 23,664*l*. If to that loss was added the loss of the last two years, the total loss on five shows only was shown to be 31,614*l*., very nearly approaching the total loss spread over the whole period of sixty years. Coming to more modern times, the shows for the seven years 1891-1897 resulted in a profit of 13,986*l*., and if from that was deducted the loss of the last two years, Birmingham and Maidstone (7,950*l*.), it left on the last nine years a profit of 6,000*l*. Taking the last four years, whilst Birmingham and Maidstone showed a deficit, the two previous shows (Leicester and Manchester) resulted in a gain of between seven and eight thousand pounds. So there was not much to be said upon that point, and this would be the answer to anyone who desired to upset the existing Charter. It was a curious coincidence that meeting should be held at the end of the cycle culminating in the Maidstone Show. It would be interesting to contemplate what would have been the attitude of the Com-

mittee if their sittings had been held after the Leicester or Manchester Shows. From the figures which he had adduced, he did not think that they were justified in saying that the showyard was a drain upon the finances of the Society.

The real question before the Council was—what was best to be done (1) in the interests of agriculture and of the agriculturists of this country, and (2) in the interests of the Society and its members? And this brought them closer to the question as to whether some modified form of migratory show would not more effectually further the interests of the three classes of agriculturists in whose welfare the Society was concerned—viz. the landlord, the tenant, and the labourer. Migratory shows had been of very great use in bringing local breeds of stock to the front. They had also enabled the people in different districts to visit the shows, and to observe the improved breeds of stock and the most modern machinery.

So far as the tenants were concerned, it was most important that these periodical meetings should be brought within their reach, so that the whole or several members of a family might visit them; whereas, under the proposed new system, involving a long railway journey, only one member of a family might be able to attend. Long intervals elapsed between particular Royal Shows in the same district, and in that interval a new generation arose which had never seen a Royal Show, and would never otherwise be able to do so.

The tendency of modern legislation was all in the direction of increased numbers of small holdings, and of the number of occupiers of land. There was also another body which had not received sufficient attention from that Society—namely, the agricultural labourers; and, knowing how scarce agricultural labour was, it was of the utmost importance that the intelligent labourer of the present day should have an opportunity of visiting the shows, and witnessing the labour-saving machinery. He should be very much surprised, moreover, if the implement-

makers did not acknowledge that they derived a considerable advantage from these shows; for it was a well-known fact that much of the best machinery had been left behind each year, and the agents of the local firms asserted that their trade was very slack for a year or two after the Society had visited their district. He (Sir Jacob) also regarded the show as a valuable recruiting ground for new members. He was aware that he should be told that a great many of the members so obtained did not remain long on the books; but even if that were so, they came on again at the next place. Then he thought that these periodical shows were due to the members in the various parts of the country, some of whom could come to other shows, but others could not. It tended to maintain public interest in the Society, which could not otherwise be accomplished.

During the thirty-five years that he had been on that Council he had taken part on three different occasions in the alterations and modifications of the then existing show system, and he was of opinion that the time had arrived for some further modification. He therefore ventured to suggest, as he had already done to the Committee, that that might be accomplished in the following directions: (1) the re-arrangement of the districts, (2) the re-arrangement of the showyard, and (3) the re-arrangement of the prize-sheet.

(1) Under the first heading he proposed that the Society should abandon its present system of divisions in order to give the Council a free hand in dealing with the question hereafter. If it were desirable he would draw a line to separate the north from the south, so as to guarantee that two shows should not be held consecutively in the same part of England. Or he would divide the country into three districts—north, midland, and south. Another alternative would be to have a northern district, and then draw a perpendicular line dividing the rest of the country into south-west and south-east districts. That was a system which had been adopted in Germany, a larger country than this, whose National Society had been

founded largely on the lines of the Royal Agricultural Society by a gentleman who had for twenty years attended their meetings, and he (Sir Jacob) thought that they could learn much from the German methods. The Society in sixty years had visited forty-two towns. Although a great deal had been made of the difficulty of finding places for the Society's shows, he was aware of various towns which had received the Society in the past, and which were able and willing to receive it again and to meet all its requirements. He might mention Carlisle, Newcastle, York, Doncaster, Preston, Shrewsbury, Derby, Nottingham, and Leicester. If the Society wanted to go to the latter place again, he could point out an available site of 100 acres near the town, with a railway on one side and a main road on the other.

(2) With regard to the showyard, he wished at once to say that he was fully prepared to accept his share of the responsibility incurred by his colleagues on that Council in trying to build up the showyard, which had by successive developments become the wonder and admiration of visitors from all parts of the world. When he was told that it was impossible to limit the extent of the showyard, he was prepared to face the question and to try to do so, for when it came to a pinch they must cut their coat according to their cloth. It was asserted that 100 acres were absolutely required, but he did not think it need necessarily be so. He proposed to reduce the size of the showyard in three different ways. First, he believed that the main avenues were 60 and 50 feet wide respectively, and although it might detract from the picturesqueness of the showyard, he would take 3 feet off each side. The space between the shedding was 20 feet, and from that he would take off 2 feet on each side on the German plan, where the spaces between the sheds were less than the depth of the sheds themselves. The question of open spaces was one which might be very easily dealt with. The cattle sheds, also, he thought, were capable of being modified and reduced. The present area was 10 feet 6 inches for bulls and

5 feet 3 inches for cows. He thought that at the Birmingham and Smithfield shows larger cattle were exhibited than at the Royal, and for the same period—viz. from Friday to Friday; and so far as Smithfield was concerned the space allowed was 4 feet per beast, and they had no parade or exercise. The same conditions applied, to a certain extent, to the exhibition of horses.

With regard to implements, he knew that there was no more popular part of the showyard; but they must be consistent, and if they reduced one part of the showyard they must do the same by the other. He thought that the exhibitors would willingly make any sacrifices which the Council might demand of them in this respect. The implement-makers, in fact, did not always secure at other shows the amount of space allotted to them in the "Royal" showyards, as the following statistics as to the space taken by six of the principal implement-makers at the Royal and Smithfield shows respectively would demonstrate:

	R.A.S.E. Feet Frontage	Smithfield Feet Frontage
Messrs. Fowler .	95	48
" Howard .	60	32
" Hornsby .	100	48
" Ransome .	100	48
" Marshall .	80	37
" Crosskill .	80	30

If the Council agreed to curtail the space for each exhibitor, he thought it would also be desirable to exclude duplicates of the same type. He might give one instance of what he meant. At one show there were exhibited twenty grindstones by one exhibitor, and of these there were only three varieties. He would also advocate the total exclusion of non-agricultural articles. If the show were fixed, the implement manufacturers would never expect to have the same amount of space as they had at the present time; and if the various modifications which he had suggested were carried out, he saw no difficulty in reducing the extent of the showyard by one-fourth.

He might take the case of Cambridge, where only 64 acres were available, and the showyard was so

awkwardly shaped that it was extremely difficult to lay out. Notwithstanding these disadvantages, however, they had a most successful show, and made a profit of 1,096*l*. Personally, he had never yet seen a showyard which was too crowded with people, and it was a fact that, however large the showyard might be, the greatest number of people would always be found congregated wherever there was anything popular to be seen. People liked to be in a crowd. Comparing Cambridge with a small showyard, to Darlington with a larger one, the former had the best of it, for Cambridge had more implements, more stock, more visitors, and 400*l*. more profit. Kilburn was, of course, exceptional: it was an international show; and in the space of 100 acres they had twice as many implements and half as many again stock as were now expected; while at Windsor the numbers were even larger.

(3) With regard to the prize list: he had always held that, as a National Society, they should, where possible, act in a national manner, and that *primâ facie* all breeds of stock should be represented. But then they were brought face to face with the fact that this plan had not always been adopted in the early days of the Society. It was not, indeed, until Kilburn that all breeds were exhibited, and he could not admit that it had been a universal success; in fact, in many cases it had been a failure. They would find on referring to the catalogue one or two entries in certain classes, and sometimes none at all, although the Society had to go to the expense of shedding, judge's fees, &c., just the same as in well-filled classes. He did not think the Society could continue this, but might very well fall back upon the plan adopted in its earlier stages. He would suggest that prizes for the principal breeds only should be given at every show, leaving the other breeds to be treated liberally on visiting their respective districts; and he believed that exhibitors would fully appreciate the Society's reasons for taking such a step. The reference to two-shear rams referred to in the report showed that there was a strong

disinclination to cut down prizes; but he would remark that there was no analogy between the course suggested by him and that adopted with regard to two-shear rams, prizes for which had been given ever since the Society started. And although, generally speaking, this might be desirable, there were some breeds in this country in which it was absolutely undesirable that there should be early lamb classes.

By the above facts he claimed to have shown that it was possible, and even desirable, to considerably reduce the size of the showyard, together with the consequent expenses, and thus to render it possible for the Society to accept sites of smaller area nearer large towns and in populous districts.

He now came to the question of fixed shows, referred to at the end of the report, and he would venture two or three objections to the propositions there put forward. In the first place, they would lose their 2,000*l.* guarantee. It had been said that the time would come when they would not be able to get the 2,000*l.*, but he had heard that for the last quarter of a century, and would hazard the prophecy that they would get it for many years to come. Then they would lose altogether the local prizes; the trials, such as of cider presses, hop washers, &c., which had been held when the Society went to particular districts, would of necessity be discontinued; and the interest in certain special breeds would naturally die out. The number of members would certainly decrease unless they went about the country, though, no doubt, they would be increased for the first year in the district where the fixed show was located, and the old members in other districts might remain on; but when they died off the Society would not be able to replace them. He had no doubt there were signs that the members would endeavour to express their own opinions on this subject. Another objection was that small tenants and labourers would not be able to attend these shows from a distance, in spite of the stress which Lord Derby had laid upon the facilities offered by excursion trains. There

were many parts of the country which were even now many miles from the railway, and it was not possible to inspire the same interest in shows held a long way off as in those which were brought especially under people's notice. He feared that, by the adoption of the principle of a fixed showyard, the Society would lose that Royal and national character which had been most wonderfully maintained for the past sixty years.

It was a favourite argument of those who advocated this change to refer to the example of the Dublin Horse Show; but he might remind them that Agriculture in Ireland was different in every respect to what it was in this country. With the exception of Belfast and Cork, there were no towns of sufficient population in Ireland to receive the National Society; and moreover the Royal Dublin Society was an institution representing various interests, of which agriculture was only one. The Dublin Horse Show had been a great success, and having been instrumental in its formation he (Sir Jacob) took great interest in it. The showyard comprised 40 acres, of which 5½ acres were covered. The land had cost 9,350*l.*, or about 240*l.* per acre, whilst the walls, buildings, and fittings had cost 60,000*l.*

He adverted for a moment to the question of the railway; even if they took a multitude to the shows, it did not necessarily follow that they would take the agricultural public. Agriculture was what this Society was started for, and he desired that they should deal fairly with members in all parts of the country, and not curtail their privileges. If the show became fixed there would be a danger of this Society gradually dwindling down to a mere horse show for professional showmen, to the exclusion of more certain rent-paying stock, such as cattle and sheep.

It might be that the time would come when a fixed show would be inevitable, but that time was not yet. If it were so, then he would approve of the Committee's report, which he had signed with a reservation. But

inasmuch as the time had not in his opinion yet arrived, he thought it only honest and prudent to attach the qualification which stood in his name, seeing that so many towns were still able and willing to receive them; and he hoped the Council would postpone the application of this recommendation at least for the present. He would implore the Council to pause for a while before abandoning a well-tryed and popular system which had worked so well for the last sixty years, and had done so much for the advancement of British agriculture, in favour of a most doubtful and dangerous experiment of substituting a drastic and untried plan, which he feared would prove the first step in the downward course, if not the absolute death-blow to this great Society.

Mr. JAMES HORNSBY said the implement exhibitors were equally divided in their opinion about the advantages of the present system and of a fixed place for the show, but there were a great many things to be taken into account before the adoption of that plan. He thought that it ought to be taken into consideration, if they were to have a permanent showyard, whether it would not be desirable that they should have fixed offices and a fixed place on the site to carry out the business of these shows. If their place of business were moved into the country, there would be much less expense incurred. He considered the three places which had been named—viz. London, Manchester, and Birmingham—were not the best places for the show, but considered Leicester the most central for railway communication and for agricultural interests. Before any place was fixed upon he thought that each selected town should be consulted and asked what accommodation they had to offer, and the best terms they could offer the Society. He was further of opinion that the Council ought to consider whether Breed and other societies would come with them and hold their shows at the same place, which would also much reduce the expenses of their Society.

The Earl of FEVERSHAM thought that this was one of the most impor-

tant questions which had ever been brought under the consideration of the Council, and he certainly agreed so far with Sir Jacob Wilson that they should not take up this new scheme in a hurried manner—i.e. that the members of the Council and the large number of members of the Society should have a further opportunity of considering the recommendations of the Committee. It seemed to him that there might be some further proposals made for meeting their present difficulties. For instance, could it not be considered whether a biennial country show could take the place of an annual show, and in the intermediate year might not the show be held in that very capacious building, the Agricultural Hall? They would then have a show in London and also in the country. For his own part, he did not consider that the present proposal would be at all desirable. Would it not be rather premature on the whole to adopt so great and wide a change? Was it not better that they should have a little more time in which to consider it? He quite appreciated the arguments used by his noble friend, Lord Derby, with regard to this question. At the same time the agriculturists of this country did not want to travel too quickly; they did not want to make too wide changes; and they would rather have a little more time to consider the matter before such a great change was brought about.

Mr. S. P. FOSTER said on one side they had before them the most excellent and capably drawn up report of the Committee, but on the other side they had not heard one single word until the very lucid statement made that morning by one of the ablest and most experienced men amongst them, Sir Jacob Wilson. Everything that Sir Jacob had stated, he (Mr. Foster) most thoroughly endorsed. He himself had had some little practice and experience in the work of the shows, and knew something of the places in the North of England. He thought that there was no doubt that in the North or Northern Midlands there were at

least eleven or twelve places available where the Society's shows might be held. He did not see that there was any necessity for a panic because the Society had lost money. Sir Jacob had remarked that it would be absolutely impossible to induce small tenant farmers and agricultural labourers to come to a show if a site for it were fixed at a distance from them of, say, 250 or 300 miles. However that might be, he could say that Carlisle was ready to receive them at the present moment; but if the show were held at Nottingham he did not think that there would be three men out of his own parish who would be able to get to the show within twenty-five years, while, if a meeting were at Carlisle, or at Preston, and they could get to and from the show in one day, they would come to visit it. That, he considered, was a strong argument why their shows should be migratory in character. He should like to ask if it were proposed to adopt the Special Committee's views without asking the members of the Society what their opinions were. He thought there was another ten years at least before them during which the Society could find places for holding its shows, and he considered that they should hesitate before taking the step proposed.

Mr. H. D. MARSHALL said that as a wrong impression might be obtained from Mr. Hornsby's remarks as to the attitude of the implement exhibitors, he thought it right to mention that at a meeting of the Agricultural Engineers' Association, nineteen of the largest firms of implement-makers were in favour of a fixed show, whilst nine of the smaller firms were in favour of the migratory system. He believed the majority of implement exhibitors would be in favour of a fixed show, and he himself thought that a permanent location in the Midlands would be the best solution of the question. A properly organised show would attract to it every person interested; and, as a matter of fact, the books of his firm showed that the Kilburn meeting was one of the best they had ever had for business, whatever its results

to the Society. Visitors now came to the Royal Shows from all over England, and there was no reason to doubt that they would come in the future if the show were fixed in an easily accessible position. The time had come to look this matter fairly in the face; and now was the time for change, if changes were to be made. He thought that if made, probably the railways of the district selected would help the Society in its acquisition of a fixed showyard.

Mr. ASHWORTH said they had all listened with great interest to Sir Jacob Wilson, because the shows had been under his special control for a great number of years. His arguments were too long for one person to answer in detail, and he (Mr. Ashworth) did not propose to attempt to do so on that occasion. He thought that Sir Jacob Wilson had forgotten what Lord Derby had stated, that the whole situation was now altered. Sir Jacob had spoken of what had answered for sixty years, and begged them to go on and wait, in the hope that things would right themselves, forgetting that the situation had entirely changed. He also made this important mistake, that he took it for granted that they were the only Society for educational purposes. If such had been the case, many of Sir Jacob's arguments would have had greater force; but let them hark back, as Sir Jacob asked them to do, to the formation of the Society sixty years ago. He (Mr. Ashworth) had been reading up the contemporary literature of that time, and he could not find that more than twenty shows existed when the Society was started. According to the *Live Stock Journal Almanac*, there were at the present time 266 Agricultural Societies, eighty Chambers of Agriculture, and over fifty Societies for the registration of pedigree stock.

Though the Society had done immense and grand work for Agriculture, they must not forget their allies, the local societies. Apart altogether from the Society's financial position—and he denied entirely that these were panic proposals—there were other reasons why the time had arrived

when the shows should become stationary, and of these he would enumerate three. The first was that by going into country districts the Society not only disorganised the local shows, but interfered seriously with their finances. In the earlier days it was impossible perhaps for the local people to see in their own districts a good exhibition of pedigree animals. He had taken the trouble to mark on a map (which he exhibited) the number of agricultural shows held at the time of the Society's first meeting at Oxford in 1839, and upon another copy of the map the principal shows held at the present day. In the first map the shows were extremely sparsely scattered, while in the second the map was so fully covered that he had been obliged to omit many of the smaller shows. But those which he had marked were sufficient to indicate the enormous increase in the agricultural show system during the past sixty years. Local societies now had such good stock exhibited at their meetings that it was only a question of degree between the winner of a prize at the Royal and the winner at the County Show. But even if it were not so, it was quite possible for local people to appreciate the difference between a good animal and a bad one, without seeing the finest specimens of the breed. One could tell the good points of a horse without having seen Persimmon or Flying Fox. Animals, of course, were not stationary, even though shows might be, but would continue to travel about from one show to another, as they did at the present time.

In his opinion, the local shows were in the position of colonies to the Royal Show, and instead of doing anything to help them the "Royal" swooped down like a huge bird of prey, and mulcted the district in the sum of something like 10,000*l.*, which had to be found by the Local Committee, besides spoiling the local show for that year. He knew that local societies dreaded the visits of the "Royal." For instance, when the Yorkshire Society found that the "Royal" was going to York this year they declined to have their show disorganised, and decided to hold it at

Doncaster. From an educational point of view, he was sorry that he could not agree with Sir Jacob Wilson at all. Sir Jacob advocated this travelling about by their Society; but the Thoroughbred Stallion Show did not travel, the Shire Horse Show did not travel, and the Dublin Show did not travel. No one, however, asserted that because these shows were stationary they were less educational, and in his opinion the "Royal" Society should not travel.

His second reason was in connection with paragraph 32 of the report. Undoubtedly a better show of implements could be held in a stationary showyard than in a travelling one. He had long looked upon the implement department of the show as certainly not less important, though perhaps less popular, than the other departments. Good work had been done in the breeding of cattle, but agricultural implement makers had done equally as much for the arable farmer. How would it have been possible, considering the state of the agricultural labour market, to have gathered in the harvest last season but for the assistance of the labour-saving machinery invented by the implement-makers? He would have the Society do all in its power to encourage the trials of new implements. It was understood, or stated, that these trials were not popular, but that they were so in the Society's early days was proved from the contemporary account of the Society's meeting at Cambridge in 1840, which said "the people flocked to the trials of implements in their thousands, in carriages and on horseback, and it was a most interesting feature of the show."

In his judgment the time had arrived, and was, indeed, overdue, for this Society to make a change. The time of the Council and of its committees was taken up with the consideration of innumerable details, and work which would normally occupy four days had to be crowded into two. Their time was indeed far too largely occupied with work necessitated by the travelling nature of the shows, to the exclusion of work indicated by the list in the Charter of other objects for which the Society was established. If they were asked what they were

doing on the scientific side of the Society's work, their answer would be they had no time to make investigations. After sixty years they still had no time to carry out many of the commands of the Charter on the subject of agricultural education, on the condition of the agricultural labourer, and of his cottages and gardens. With regard to discovering new vegetables for the food of man and of stock, nothing had been done since the days of Turnip Townshend. He did not want to be misunderstood. Their Society had done, and was doing, a grand work, and he felt sure that there was abundant evidence that it had more than satisfied the most ambitious of its promoters. The adoption of the principle of a fixed showground would not only be continuing, but would tend to accelerate, that work, and it was for these reasons that he asked the Council to vote for the report then before them.

Earl EGERTON OF TATTON thought that the Council were much indebted to Sir Jacob Wilson and Mr. Ashworth for having placed before them the two sides of the question at issue so clearly and fully. On the whole, he thought the report of the Committee was deserving of support, though he did not think the Society should take any steps of the nature proposed without having some definite plan before them which they could discuss, and which would set forth the advantages and disadvantages between the new and the old systems. He thought there might be many objections to a fixed position in the centre of England. On the other hand, they would have to pay a higher price for a suitable location near London than in the country, and it appeared that there were large towns in the centre of England ready to receive them. The question was whether it was now time to make a change. It was quite clear that if they had one place for their show, its position would be a very difficult one to suggest; and before they took any steps in the matter he should like to know exactly what sites were offered, their advantages and disadvantages, what the expense would be,

and how the expense would be provided for.

Mr. J. BOWEN-JONES remarked that he had very little to say with regard to the report, except that he recognised that it had been drawn up with the greatest care, and the various facts had been put before them in a very clear and lucid manner. On the other hand, he should like to make acknowledgment of the force of Sir Jacob Wilson's speech, which, both in construction and argument, was most admirable. The only question that it appeared that the Council had to decide was whether they were prepared to take a leap in the dark now, or try still further to carry out the old principles on which the Society had been working since its formation. One question had been alluded to by Lord Egerton—viz. what would the cost of the permanent showground be, and what amount of money would be required to be expended on buildings, as against the annual expenditure on their exhibitions? He thought the arguments *pro* and *con* had been well gone over, and he did not intend to detain the Council by going into them again, except to say that if they accepted Mr. Ashworth's arguments as to the Society's peripatetic shows being carried out to the disorganisation of other societies, he simply held a brief for the small societies at the expense of the great parent Society. Moreover, he (Mr. Bowen-Jones) did not think that a comparison with the pedigree societies holding stationary shows was at all to the point. With the expression of these views, he hoped the Council would take the opinion expressed by many practical men, and delay determining upon the course suggested by the Committee.

Earl CAWDOR said his own feeling was that the Council should take a decided course in one direction or another. Sir Jacob Wilson had put forward, in a very able speech, his reasons for throwing over the report, although he had signed it. He (Lord Cawdor) had listened very attentively, and had failed to discover in Sir Jacob's speech one single item of agreement with the report; indeed

his object seemed to be to do away with and destroy the report.

Sir JACOB WILSON (interposing) said that if it were proved that the time had come for the termination of the Society's migratory shows, he would withdraw every objection, but it was because he was not satisfied on that point that he had signed the report with a reservation.

Lord CAWDOR said that did not alter his argument, for Sir Jacob had advocated changes which were directly in opposition to the terms of the report. What they were asked really to consider was whether this report should be adopted, or rejected, or postponed for further consideration. He had not heard any argument for postponing it. They must of course respect the opinion of those men of experience who advocated the continuance of their moving and wandering shows, but the weight of evidence in the report, the whole burden of the evidence, tended in one direction—viz. that if the migratory shows were continued their size would have to be curtailed. This was the course advocated by Sir Jacob Wilson, but he (Lord Cawdor) ventured to join issue with Sir Jacob on that point. He hoped to see their Society and its shows still growing. Indeed, he had never found in the past that Sir Jacob Wilson had been one to advocate the diminishing of the size of the shows, but rather the contrary. Was the organisation of the Society to be curtailed because they could not get showyards large enough for their purposes near populous centres? He was of opinion, too, that they should not cut down the implement department of the Society. The exhibition of machinery such as appeared in their showyards was of great advantage as showing the means by which labour could be saved. The development of this branch of the show could only be accomplished by taking some site larger than they had at present.

He thought the case of the Special Committee had been made out—to his satisfaction, at all events. The question had been most carefully considered, and what the Council had

to do was first of all to settle some principle, and the question of cost would then come afterwards. He hoped they would pass the resolution for the adoption of the principle of a fixed site, and then refer it to the committee for consideration and further report. One or two likely suggestions had been made by various speakers, but he did not think Lord Feversham's suggestion as to a show in the country every two years needed much consideration, and he hoped he should never live to see the Royal Agricultural Society at the Agricultural Hall. He felt that they ought, and were now in a position, to make up their minds one way or the other in respect of the principle advocated in the report.

Mr. MARTIN J. SUTTON said his chief desire in speaking was to beg that the Council would not proceed to make such a drastic change as was proposed without being sure that they were in touch with their *clientèle*. He had not met one single farmer who had not expressed his aversion to the proposed change. Though an exhibitor in the implement department of their shows himself (as were other members of their body), he did not speak as such, for undoubtedly the large implement exhibitors, as well as his own firm, would find a considerable economy in a permanent showyard. But the question was—what could best be done in the interests of the agricultural members of their Society? He regretted to say that he feared the Council were out of touch with the members of their Society on this question, and he should rather wish that the idea of endeavouring to secure a permanent central showground should be postponed until some measures had been taken to discover the wishes of the members of the Society thereon.

Sir NIGEL KINGSOOTE said that his experience was totally different from Mr. Sutton's. Practically every one who had spoken and written to him on the subject was in favour of a permanent yard. He had also received many letters, some from correspondents personally unknown to him, supporting the proposals of

the Committee. He had approached the consideration of the report of the Committee with a perfectly open mind, and, if anything, with a bias against change. He was, however, now perfectly convinced that the time had come when they were doing very little good by going about the country with their shows, and he believed they should be doing a great deal more good if the practice were discontinued. He could not but believe, from the evidence which had been brought before them, that the Society would be taking a wise step in carrying out the Committee's recommendations. He wished, therefore, to refute the arguments which had been placed before them as to the Council postponing coming to a decision in the matter. They had got a site for a show in 1901; but where were they to go in 1902? Sir Jacob had told them that Carlisle was ready to receive them; but when they last went to Carlisle, in 1880, they occupied a very poor showyard, and the ground was half under water, and besides, they had lost money there. Newcastle had likewise been mentioned, but there again the Society lost a good deal of money when they last visited that town in 1887.

He should like to say a word as to the suggestion that they should take the members of the Society into consultation before proceeding further with this question. He himself was not aware of any society in England which had a more representative Council than they had, and if their members did not put trust in the Council, they might, he thought, give up altogether. He sincerely hoped that this report would now be received and adopted by the Council. They were compelled to look to the future; and, speaking as Chairman of their Finance Committee, he felt that the financial risks were too great for the existing system to be continued, even if sites could be found for the shows in different towns, which had been shown to be practically impossible.

The CHAIRMAN said that they had had a very interesting discussion, and he thought he might now put the question. He took for granted that

an opportunity would be given for the members of the Society to express their opinion on any change which might be decided upon by the Council.

Mr. SUTTON said that he was afraid he must press the opinion he had ventured to express, in the form of the following amendment to the report: "That the question of adopting the principle of a permanent central showyard be postponed until some means have been taken to discover the feeling of the members of the Society."

Mr. FOSTER, agreeing that the members should have an opportunity of expressing their views on this important subject, formally seconded the amendment.

Mr. CRUTCHLEY pointed out that there would be insuperable difficulties in ascertaining the aggregate opinion of members of the Society with reference to the report of the Committee. Any such opinion, even if it could be obtained, would be without responsibility. The responsibility for doing what they considered best in the general interests of the Society rested on the Council, who were the body appointed by the Charter to manage and superintend the Society's affairs. The Council were in possession of all the facts on which to form a judgment, and the general body of members would look to and had a right to expect from them an expression of their opinion on the proposal now submitted to them.

Earl CAWDOR said that the recommendation of the Committee, if adopted by the Council, would, of course, form part of the report of the Council to the Annual General Meeting, when the members would have their regular opportunity of expressing their views on the Council's action. What Mr. Sutton's amendment asked them to do was not to take any sort of action, or to express any opinion to the members; in effect, therefore, to go to the members to say that they as the responsible governing body of the Society had no minds of their own as to what ought to be done. He thought the Council were capable of coming to a con-

clusion on the matter, and that there was no reason for adopting any other than their customary procedure in matters that came before them for decision.

After some further discussion, in which the Hon. CECIL PARKER, the Duke of RICHMOND and GORDON, the Marquis of GRANBY, and others took part, Mr. FOSTER said that if this matter was to be brought before the members in the usual way, he would be quite satisfied.

Mr. SUTTON said that as his seconder had withdrawn his support to the motion, his amendment fell to the ground.

On the CHAIRMAN proposing to put the original motion,

The Hon. CECIL PARKER said he would like, as mover of the adoption of the report, to make a few remarks on the discussion. He had listened with much interest to the speech of Sir Jacob Wilson, and he only regretted that Sir Jacob Wilson had not thought proper to bring before the Committee, of which he was a member, the several points that he had for the first time detailed that day. At the first meeting of the Special Committee, held on October 30, he (Mr. Parker) had put before them a memorandum of his own views, which had been considered at a further meeting on December 4, when the whole question was discussed. Two months elapsed between the interchange of views of the different members of the Committee and their meeting on February 5 to consider and settle a final report, and on all those three occasions Sir Jacob had

had an opportunity of discussing with his colleagues the points which he had now made in his speech. All Sir Jacob's arguments were capable of being answered, and most of them were already answered in the report. In view, however, of the debate which the Council had heard that day, he would now only ask them to express their opinion as to whether, looking to the facts stated in the report, the time had not come when the change should be made which was recommended by the Committee in the report, which had now been before the Council and the public for a month. It had been said that this was panic legislation. This he distinctly denied, but if the matter were allowed to drift on as had been suggested, the Society would undoubtedly be obliged to have panic legislation in a very few years.

The CHAIRMAN then put the motion for the adoption of the report, which, on a division, was carried by 38 votes to 4.

Earl EGERTON OF TATTON asked what were the next steps proposed to be taken by the Committee, and moved that they be reappointed, with instructions to make inquiries as to any possible sites for a permanent showyard, and to prepare estimates of expense.

The Hon. CECIL PARKER said it had been his intention to move such an instruction to the Committee, but he was content to second Earl Egerton's motion.

This motion was carried unanimously, and the proceedings then terminated.

## Ordinary Monthly Council.

WEDNESDAY, MARCH 7, 1900.

THE EARL OF COVENTRY (EX-PRESIDENT) IN THE CHAIR.

At the conclusion of the business of the Special Council, the Ordinary Monthly Meeting of the Council was held.

(For list of Members of the Council present, see page xxxv).

### Election of New Members.

The minutes of the last monthly meeting of the Council, held on February 7, 1900, having been taken as read and approved, the election of the following eighteen members was proceeded with:

ARGLES, Canon G. M...St. Clement's Rectory, York.  
BECKETT, John Hall Farm, Deighton, York.  
BORTON, Lieut.-Colonel A. C...Cheveney Hunton, Maidstone.  
CLOUGH, Arthur H...Castletop, Burley, Ringwood, Hants.  
CUFF, Sidney W...St. Mildred's, New Barnet.  
ELGAR, Walter R...Park Road, Sittingbourne.  
GRIMSHAW, A. G. Cecil...Aspley Guise, R.S.O., Beds.  
HALEY, Alfred A...Holmesfield, Wakefield.  
MILLS, Joseph R...Oaklands, East Peckham, Tonbridge, Kent.  
NICHOLSON, James P...73 North Gate, Newark.  
NUNN, J. Sturley...Little Welnetnam Hall, Bury St. Edmunds.  
PLATT, Algernon J. F...Barnby Manor, Newark.  
POLLOCK, Andrew...Mauchline, Ayrshire.  
PRESTON, W. H...Heigholme, Leven, Yorkshire.  
SCHOLFIELD, Edward P...Sandnall, Howden, Yorks.  
STRICKLAND, Emanuel...The Manor, Sinnington, R.S.O., Yorks.  
TATE, Joseph G...Rutland Estate Office, Ilkerton, Derbyshire.  
TUNBRIDGE WELLS AGRICULTURAL SOCIETY, Tunbridge Wells.

The reports of the various Standing Committees were then presented and adopted as below:

### Finance.

Sir NIGEL KINGSOOTE (Chairman) reported that the accounts for the month ended February 28, 1900, as certified by the Society's Accountants, showed total receipts amounting to 1,142l. 7s. 8d., and expenditure

amounting to 1,516l. 0s. 9d. Accounts, amounting in all to 4,324l. 10s. 7d. had been passed, and were recommended for payment. The Secretary had laid upon the table the balance-sheet and accounts for 1899, which had been ordered to be submitted to the Auditors, and, if approved by them, to be published in the usual way (see pages xii to xvii).

### Journal.

Sir JOHN THOROLD (Chairman) reported that various matters connected with the Journal had been discussed and settled. The Committee had considered the contents for the forthcoming number of the Journal, and had given instructions to the Editor thereon. Proofs of a reproduction of the portrait by George Richmond, R.A., of Philip Pusey, which it was proposed should form the frontispiece to the volume of the Journal for 1900, had been submitted and approved.

### Chemical and Woburn.

Mr. STANFORTH (Chairman) submitted the recommendations of this Committee as to various feeding and field experiments now in progress on the Society's experimental farm at Woburn, and presented a report as to (1) basic slag, (2) decorticated cotton cake and meal, and (3) compound feeding cakes, which the Committee recommended for publication in the Journal (see page 87).

### Botanical and Zoological.

Mr. WHEELER (Chairman) reported that the Committee had given consideration to a joint report on the Society's Grass Experiments prepared by the Consulting Botanist and the Consulting Chemist, which they proposed should appear in the forthcoming number of the Journal

(see page 116). They recommended that a Report by Dr. Voelcker on experiments conducted at Woburn on the eradication of Weeds should also appear in that number (see page 110).

### **Veterinary.**

The Hon. CECIL PARKER (Chairman) reported that the Annual Report for 1899 of the Royal Veterinary College had been considered, and referred to the Journal Committee for publication in the next number of the Journal (see page 93). In view of the Order of the Board of Agriculture declaring the City of York a "swine-fever infected area," the question of the Society holding an exhibition of pigs at the forthcoming meeting at York had been postponed until the next meeting of the Committee, when they hoped to be able to arrive at a definite decision in the matter. The list of veterinary surgeons to assist in the veterinary examination of horses at the York Meeting had been finally approved, and the Committee recommended its publication in the Journal (see page 1vi).

Professor MCFADYEAN had presented the following report:

**ANTHRAX.**—During the second four weeks of this year fifty-three outbreaks, involving seventy-eight cases of the disease, have been reported. During the same period of last year the number of outbreaks was forty-three, and the number of animals attacked eighty.

**GLANDERS.**—Recent returns with regard to this disease show a serious increase in the number of outbreaks. During the second four weeks of this year these amounted to ninety-three, with 191 animals attacked, as against forty-six outbreaks and ninety-three animals attacked in the corresponding four weeks of last year.

**SWINE FEVER.**—During the second four weeks of this year 146 outbreaks were reported, this comparing very favourably with the 189 outbreaks notified during the same period of 1899.

**FOOT-AND-MOUTH DISEASE.**—Since this disease was detected in Norfolk five weeks ago, seven outbreaks, including ninety-nine cases, have been reported. Five of these outbreaks were in Norfolk, one in Suffolk, and one in Bedfordshire. No fresh outbreak has been detected for about a fortnight, and there appears to be reasonable grounds for hoping that the measures taken by the Board of Agriculture have succeeded in stamping out the disease.

**RABIES.**—No case of this disease has been detected during the current year.

**MISCELLANEOUS.**—The number of morbid specimens forwarded to the research labora-

tory at the Royal Veterinary College for examination during the month of February was twenty-nine. These comprised cases of anthrax, tuberculosis, glanders, diseases caused by worm parasites, tumours, etc. The experiments regarding Tubercula at the Royal Veterinary College have been continued.

### **Stock Prizes.**

Mr. SANDAY (Chairman) reported that the Committee had considered the question of the exhibition of pigs in the York showyard, in view of the fact that the City of York was at present scheduled as a "swine-fever infected area." They had settled a circular letter to be sent out, if necessary, to intending exhibitors of pigs, stating the conditions under which entries could be accepted for the meeting. The Committee gave notice that they would ask for a vote of 5,000*l.* for prizes to be offered at the Meeting of 1901.

### **Judges Selection.**

Mr. SANDAY (Chairman) reported that the gentlemen who had been invited to act as judges in the several departments of the York Meeting had, with very few exceptions, accepted the Society's invitation. Arrangements had been made for the completion of the list forthwith, and for its publication in the Journal (see pages liii to lvi).

### **Implement.**

Mr. SANDAY, in the absence of Mr. Frankish through indisposition, reported from the Implement Committee that the list of judges of implements for the York Meeting had now been completed. The Committee had considered regulations for the trial and exhibition of milking machines and of sheep-shearing machines at York, and recommended their adoption as amended. They had decided that sheep-shearing machines worked by pedal power should be tried with the hand machines entered in Class V. They had also considered and settled the following regulations for the trial of Oil Engines and Ice-Making Plant for the Country Meeting of 1901:

#### *Prizes for Oil Engines and Ice-making Plant.*

In connection with the Society's Country Meeting of 1901, the following Prizes for Implements will be offered:

	1st Prize.	2nd Prize.
<b>Class I.—PORTABLE OIL ENGINES</b>	40l.	20l.
(Power not to exceed 15 B.H.P.)		
<b>Class II.—AGRICULTURAL LOCOMOTIVE OIL ENGINES</b>	40l.	20l.
(Power not to exceed 20 B.H.P.)		
<b>Class III.—SMALL ICE-MAKING PLANT, SUITABLE FOR A DAIRY</b>	15l.	—
(Output not to exceed 4 cwt. in 10 hours.)		

## REGULATIONS FOR TRIALS.

### Classes I. and II.—Oil Engines.

1. The Oil Engines entered in Classes I. and II. are to be of the Portable and Agricultural Locomotive Types, of a power not to exceed 15 B.H.P. for the former and 20 B.H.P. for the latter.

2. The trials will take place in the Cardiff Showyard, about the time of the Society's Meeting in 1901.

3. A covered and locked building under the charge of the Society's officers will be provided, in which the brake trials of the engines will be conducted. Further haulage trials for the agricultural locomotives will be arranged for on suitable ground.

4. Every competitor must himself provide for the delivery of his engine to the trial shed not later than two days before the date on which the trials will be commenced, and for its removal therefrom so soon as required by the Society.

5. The necessary supply of petroleum and water for trials will be provided by the Society. All the engines will be worked with the same sample of oil, which shall be one of the well-known brands (specific gravity about '82). If considered desirable by the Judges, a further trial of the selected engines may be made with a cheaper oil.

6. A general outline drawing, giving overall dimensions, must accompany the entry of each engine, so as to enable the necessary preparations for testing to be made.

7. Each engine must be fitted with suitable indicating gear, to be approved by the Engineer, a revolution counter, and fly-wheel with turned flat face on which the brake gear may be applied.

8. The oil-supply tank to the engine must be fitted with a draw-off cock or plug, so that the tank may be completely emptied.

9. The adaptability of each engine for general purposes on a farm will be considered, especially as regards strength, simplicity of design, durability, stability, and freedom from fouling.

10. After each engine has been got into place, the competitor will be allowed a preliminary run, to satisfy himself that the engine is in proper working order.

11. The engines must all be ready to start for trial on a given date. They will then have to run three days, running ten hours per day on their declared brake load, the petroleum and lubricating oil being weighed out.

12. Each competitor will be allowed one attendant only in charge while the engine is running; such attendant will be under the direction of the Judges.

13. A responsible representative must also attend to give the description and explanation of the engine required.

14. At the end of the above run, each engine will go just as it stands on to a full load trial, during which indicator diagrams will be taken, brake load recorded, oil used weighed, and circulating water measured. These will be followed by light and half load trials under similar conditions, and in the case of Class II. (Agricultural Locomotives) haulage trials.

15. The points to which the special attention of the Judges and Engineers will be particularly directed are—

- (1) Simplicity, workmanship, and durability, combined with facilities for repairs.
- (2) Economy in getting to work and attendance.
- (3) Consumption of oil and circulating water.
- (4) Governing power and uniformity of speed.
- (5) Efficiency.
- (6) Cost.
- (7) Weight, compared with power.
- (8) Facility of transport, and stability.
- (9) Arrangements and capacity for carrying oil and circulating water.
- (10) (*Class II. only*) Facility of starting, steering, and turning.

### Class III.—Ice-making Plant.

1. The trials of the machines entered in Class III. will be held in the Cardiff Showyard during the week preceding the Show. Due notice of the exact date of the trials will be given.

2. The Society will provide the necessary shedding and insulated chamber in which the trials will take place, and in which the machines will remain during the Show, when demonstrations of their working will be made at times to be regulated by the Stewards.

3. Competitors must send a complete specification of their plant, with a general arrangement drawing showing the space occupied.

4. Competitors must provide all necessary chemicals and materials. The Society will lay on a supply of water for cooling purposes.

5. The power taken to drive the compressors will be duly tested, and the efficiency of the machines will be measured by the "thermal units" expended in the cooling of water.

6. In each case the amount and temperature of the cooling water will be carefully measured.

7. The condition of the air as regards moisture in the insulated chamber will be duly noted.

8. The points to which the special attention of the Judges and engineers will be directed are—

- (1) Price.
- (2) Power taken to drive machine compared with the output of the machine.
- (3) Quantity of water used in condenser.
- (4) Attendance.
- (5) Nature of chemicals used and cost of same.
- (6) Condition of atmosphere in insulated chamber.
- (7) The capacity of the compressor with regard to the output of the machine.

*The Entries for these Prizes must be made on or before Friday, March 15, 1901, and must be accompanied by a deposit of 10l. for each entry. Such deposit will be forfeited if the implement is not submitted for competition at the time appointed for the trials, and is not exhibited at the Cardiff Meeting.*

By Order of the Council,

13 Hanover Square,  
London, W.,  
March 7, 1900.

ERNEST CLARKE,  
Secretary.

### Showyard Works.

Mr. CRUTCHLEY reported from the Showyard Works Committee that the fence enclosing the showground had been completed, and that the horse-boxes had been commenced. The Local Committee were laying the water-main into the showyard. The Committee had considered various other details relating to the York Meeting, and had given instructions thereon.

### Selection.

Sir JOHN THOROLD (Chairman) reported the recommendation of the Committee that Earl Cawdor be elected a Trustee of the Society in the room of the late Duke of Westminster, and that the Hon. Cecil T. Parker be elected a Vice-President, in the room of Earl Cawdor. The Committee further recommended that Earl Spencer and Earl Egerton of Tatton be asked to act as the Society's representatives at the Conferences and Congress on agricultural matters, to be held in Paris in June and July next; and that the Secretary should represent the Society at the Jubilee celebration of the Royal Meteorological Society in April next.

Formal resolutions for the election of Earl Cawdor as a Trustee, and the Hon. Cecil T. Parker as a Vice-President were passed, on the motion of Sir JOHN THOROLD, seconded by Earl SPENCER.

### Education.

Lord MORETON (Chairman) reported the recommendation of the Committee that the English examination for the National Diploma in Dairying should take place at Reading from September 24 to 27 next, and that Mr. Dugdale, who had kindly consented to act, be re-appointed steward of the examination.

An invitation from Mons. Casimir-Perier for representatives of the Society to take part in the International Congress on Agricultural Education to be held from June 14 to 16, 1900, had been received. The Committee were of opinion that it would be desirable that the Society should, if found practicable, be represented on this occasion, and had nominated Mr. Martin J. Sutton to act as delegate from the Education Committee. The Committee had given further consideration to the subject of Elementary Education in Rural Districts, and had passed the following resolutions, which they submitted for the approval of and confirmation by the Council:

1. That in rural elementary schools it is desirable that the instruction be adapted to the requirements of country life.

2. That a copy of this resolution be sent to the Lords of the Committee of the Council on Education with a request that they would receive a small deputation from the Council of this Society to confer with the Department on the subject.

### Dairy.

Mr. DUGDALE (Chairman) reported that the Committee had considered a request from the Secretary of a Departmental Committee of the Board of Agriculture on milk standards, that the Society should nominate a witness to give evidence before the Committee. They recommended that the name of Colonel Curtis-Hayward should be sent to the Committee. They had considered and settled various details relating to the Dairy at the York Meeting, and had given instructions thereon.

### Miscellaneous.

Further correspondence with the Town Clerk of Cardiff as to the Country Meeting of 1901 was submitted, and the settlement of the matter referred to Mr. Sanday and Mr. Crutchley, who had formed the Committee of Inspection.

Various letters on the subject of the proposed permanent showyard for the Society were laid upon the table and were, on the motion of Mr. CRUTCHLEY, referred to the Special Show Committee for consideration.

The Council then adjourned until Wednesday, April 4, 1900, at 12 noon.

# LIST OF JUDGES

IN THE SEVERAL CLASSES AT THE  
YORK MEETING, JUNE 16 TO 22, 1900.

## IMPLEMENTS.

**Horse-power Cultivators (Class I.)  
and Steam Diggers.—(Class II.)**

WALTER BUTLER, 2 Whitehall Court,  
London, S.W.

Professor W. F. DALBY, Technical  
College, Finsbury, London, E.C.

C. W. LISTER KAYE, Estate Office,  
Osberton, Worksop.

**Milking Machines.—Class III.**

J. BROUGHTON DUGDALE, Wroxall  
Abbey, Warwick.

FRANCIS E. WALKER, Escrick, York.

**Sheep-shearing Machines.**

*Classes IV. and V.*

JAMES P. CASE, Binham Abbey,  
Wighton, R.S.O.

C. W. LISTER KAYE, Estate Office,  
Osberton, Worksop.

**Miscellaneous Implements.**

*(Entered for Silver Medals.)*

J. BROUGHTON DUGDALE, Wroxall  
Abbey, Warwick.

THOMAS STIRTON, Bawdsey Estate  
Office, Woodbridge, Suffolk.

## HORSES.

**Hunters.—Classes 1, 3, 5-8.**

JOHN WATSON, Bective, Ireland.

WILLIAM WRIGHT, Wollaton, Not-  
tingham.

**Hunters and Hacks.—Classes 2, 4, 9-13.**

Col. ANTHONY MARSHALL, Anstead,  
Obat Hill, Northumberland.

E. P. RAWNSLEY, Girsby Manor,  
Lincoln.

**Cleveland Bays.—Classes 14-21.**

THOMAS PETCH, Barns Farm, Skel-  
ton-in-Cleveland, Yorks.

GEORGE C. WHITWELL, Eaglescliffe,  
R.S.O., co. Durham.

**Coach Horses.—Classes 22-29.**

HARTAS FOXTON, Escrick, York.

WILLIAM HARRISON, Easingwold,  
Yorks.

**Hackneys.—Classes 30-43.**

ARTHUR E. EVANS, Bronwylfa, near  
Wrexham.

Sir GILBERT GREENALL, Bart.,  
Walton Hall, Warrington.

**Ponies, Harness Horses and Ponies.**

*Classes 44-47 & 58-60.*

Sir H. F. DE TRAFFORD, Bart.,  
Hill Crest, Market Harborough.

JOHN M. MARTIN, 5 Drummond  
Place, Edinburgh.

**Shetland Ponies, Mountain and Moor-  
land Ponies.—Classes 48, 49 & 50, 51.**

J. J. R. MEIKLEJOHN, Novar, Evanton,  
Ross-shire.

JOHN M. MARTIN, 5 Drummond  
Place, Edinburgh.

**Polo Ponies.—Classes 52-57.**

WALTER S. BUCKMASTER, Croft  
House, Stansted, Essex.

Rev. T. F. DALE, East India United  
Service Club, St. James's Sq., S.W.

**Shires.—Classes 61-67.**

H. R. HART, Cannock, Staffordshire.

Captain HEATON, Worsley, near  
Manchester.

**Glydesdales.—Classes 68-73.**

ABRAM KEER, Old Graitney, Carlisle.

JAMES MCALISTER, Meikle Kil-  
mory, Rothesay, N.B.

**Suffolks.—Classes 74-79.**

EDWARD H. PRESTON, Wood Farm,  
Worlingworth, Wickham Market,  
Suffolk.

SAMUEL TOLLER, Woodbridge, Suf-  
folk.

**Draught Horses, of any Breed, in Harness.**—*Classes 80–85.*

(Judges to be selected after the closing of Entries on May 15).

### **CATTLE.**

**Shorthorns.**—*Classes 86–92.*

GEORGE ASHBURNER, Low Hall, Kirkby-in-Furness, Lancs.

JOHN C. TOPPIN, Musgrave Hall, Skelton, Penrith.

**Herefords.**—*Classes 93–99.*

JOHN HILL, Marsh Brook House, Church Stretton, Salop.

F. W. SHUKER, Scorrier, Cornwall.

**Devons.**—*Classes 100–105.*

HERBERT FAETHING, Holway House, Taunton.

C. MENHINICK, Lower Amble, Wadebridge.

**Sussex.**—*Classes 106–110.*

ALFRED AGATE, Grandford House, Horsham.

JOHN NOAKES, Furnace Farm, Lamberhurst.

**Longhorns.**—*Classes 111 & 112.*

JOHN T. OXLEY, Stowe, Buckingham.

A. S. BERRY, Pheasey Farm, Great Barr, Birmingham.

**Welsh.**—*Classes 113–117.*

O. H. FOULKES, Bodrwyn, Llangefni, Anglesey.

WILLIAM JONES, Llyngwyn, Chwilog, R.S.O., Carnarvonshire.

**Red Polled.**—*Classes 118–122.*

A. D. BRUCE, Elvetham Estate Office, Winchfield, Hants.

J. STURLEY NUNN, Little Welnetham Hall, Bury St. Edmunds.

**Aberdeen Angus.**—*Classes 123–127.*

ROBERT BRUCE, Leinster House, Dublin.

GEORGE J. WALKER, Portlethen, Aberdeen.

**Galloways and Ayrshires.**

*Classes 128–132 & 139–142.*

SAMUEL CLARK, Netherthirid, Castle Douglas, N.B.

ROBERT SHENNAN, Balig, Kirkcudbright.

**Highland.**—*Classes 133–138.*

J. R. CAMPBELL, Shinness-by-Lairg, Sutherland, N.B.

DUNCAN MCDIARMID, Bank of Scotland House, Aberfeldy, N.B.

**Jerseys.**—*Classes 143–147.*

HUGH C. SMITH, Mount Clare, Rochampton.

**Guernseys.**—*Classes 148–152.*

G. TITUS BARHAM, Sudbury Park Farm, Harrow, N.W.

H. J. GIBBS, Milford, Salisbury.

**Kerry and Dexter.**

*Classes 153–156.*

H. D. D. BETTEBRIDGE, Drayton House, Littlebury, Essex.

A. D. BRUCE, Elvetham Estate Office, Winchfield, Hants.

**Dairy Cows.**—*Class 157.*

J. STURLEY NUNN, Little Welnetham Hall, Bury St. Edmunds.

JOHN T. OXLEY, Stowe, Buckingham.

### **SHEEP.**

**Leicesters.**—*Classes 158–162.*

T. H. HUTCHINSON, The Manor House, Catterick, Yorks.

BENJAMIN PAINTER, Cowclose Farm, Burley-on-the-Hill, Oakham.

**Cotswolds.**—*Classes 163–167.*

J. J. GODWIN, Troy, Somerton, Banbury, Oxon.

T. R. HULBERT, Powyke, Worcester.

**Lincolns and Devon Long-wools.**

*Classes 168–173 & 212, 213.*

ROBERT FISHER, Leconfield, Beverley, Yorks.

WILLIAM HESSELTINE, Beaumont Cote, Barton-on-Humber.

**Oxford Downs.**—*Classes 174–178.*

JAMES P. CASE, Binham Abbey, Wighton R.S.O.

A. F. MILTON DEUCE, 16 Queen Street, Oxford.

**Shropshire Rams.**

*Classes 179–182.*

A. S. BERRY, Pheasey Farm, Great Barr, Birmingham.

J. E. FARMER, Felton, Ludlow.

**Shropshire Ewes.**

*Classes 183 & 184.*

THOMAS A. BUTTAR, Corston, Coupar Angus, N.B.  
WILLIAM THOMAS, The Beam House, Montford Bridge, Salop.

**Southdowns.—Classes 185–189.**

EDWARD HOBGEN, Shripney, Bognor, Sussex.  
D. F. SMITH, Steward's Office, Easton Park, Wickham Market, Suffolk.

**Hampshire Downs.—Classes 190–194.**

WILLIAM M. HARRIS, Long Sutton, Winchfield, Hants.  
W. T. TWIDELL, Mays Farm, Crowmarsh, Wallingford, Berks.

**Suffolks.—Classes 195–199.**

CHARLES H. CORDY, Walton, Ipswich.  
J. W. EAGLE, The Hall, Walton-on-Naze, Essex.

**Border Leicesters.—Classes 200–204.**

JOHN DAVISON, Ulgham Park, Morpeth.  
JOSEPH LEE, Markle, Prestonkirk, East Lothian.

**Wensleydales.—Classes 205–209.**

B. J. HODGSON, Hallwith, Spennithorne, Leyburn, Yorks.  
THOMAS JACKSON, Netherbeck, Carnforth.

**Kentish or Romney Marsh.**

*Classes 210 & 211.*

JOHN S. S. GODWIN, Hazlewood, Hadlow, Tonbridge.  
HENRY RIGDEN, Lyminge, Hythe, Kent.

**Somerset and Dorset Horned.**

*Classes 214 & 215.*

HERBERT FARTHING, Holway House, Taunton.  
G. R. PITFIELD, Eype, Bridport, Dorset.

**Cheviots.—Classes 216–218.**

NORMAN REID, Newkelso, Strathcarron, Ross-shire.  
H. THOMPSON, Cleugh Brae, Otterburn.

**Black-faced Mountain.**

*Classes 219–221.*

JAMES GREENSHIELDS, Westtown, Coalburn, N.B.  
JAMES MOFFAT, Gateside, Sanquhar, N.B.

**Herdwicks and Welsh.**

*Classes 222, 223, & 224, 225.*

WILLIAM COOKBAIN, Far Row, Threlkeld, Cumberland.  
THOMAS MORRIS, Pentref, Llanymynech, Oswestry.

**PIGS.**

**White.—Classes 226–237.**

ANTHONY F. NICHOL, Bradford, Bedford, Northumberland.  
Major F. A. WALKER-JONES, The Manor House, Burton, Carnforth.

**Berkshire.—Classes 238–241.**

ARTHUR S. GIBSON, The Elms, Rudington, Nottingham.  
HEBER HUMFREY, Shippon, Abingdon.

**Tamworth and Blacks.**

*Classes 242–245 & 246, 247.*

GEORGE F. HEMPSON, Good Hall, Ardleigh, Essex.  
JOHN NORMAN, Cliff House, Tamworth.

**POULTRY.**

*Classes 248–245.*

D. BRAGG, Aikton, Wigton, Cumberland.  
EDWARD BROWN, The Chestnuts, Theale, Berks.  
W. FORRESTER ADDIE, Estate Office, Powis Castle, Welshpool.  
ARTHUR C. MAJOR, Park Farm, Ditton, Langley, Bucks.  
J. P. MARX, Basford, Nottingham.

**PRODUCE.**

**Butter.—Classes 346–349.**

Miss F. COWARD, Colt Park, Ulverston, Lancs.  
Miss E. A. ROBERTS, Lleweni Hall, Denbigh.

**Cheese.—Classes 350-361.**

JOHN BENSON, Dale Road, Buxton,  
Derbyshire.  
H. HEWITT, 105 Victoria Street,  
Westminster, S.W.

**Cider and Perry.—Classes 362-365.**

C. W. RADCLIFFE COOKE, M.P.,  
Hellens, Herefordshire.  
CHARLES ROOTES, Hereford.

**Mives and Honey.—Classes 366-389.**

R. A. H. GRIMSHAW, Hall Lane,  
Chapeltown Road, Leeds.  
HENRY JONAS, Portley Wood, Whyte-  
leaf, Surrey.

**HORSE-SHOING COMPETITIONS.**

HENRY G. LEPPER, M.R.C.V.S.,  
Walton Street, Aylesbury  
JOHN MALCOLM, F.R.C.V.S., Holliday  
Street Wharf, Birmingham.

**VETERINARY INSPECTORS.**

Professor Sir GEORGE BROWN, C.B.,  
Bryn Hyfryd, Harrow.  
JOHN BELL, M.R.O.V.S., Carlisle.  
W. J. T. BOWER, M.R.C.V.S., East  
Rudham, Swaffham.  
WILLIAM FAWDINGTON, M.R.C.V.S.,  
St. John's Street, York.  
R. J. HICKS, M.R.C.V.S., Market  
Weighton.  
HENRY G. LEPPER, M.R.C.V.S.,  
Walton Street, Aylesbury.  
Professor JAMES MCQUEEN,  
F.R.C.V.S., Royal Veterinary Col-  
lege, Camden Town, N.W.  
JOHN MALCOLM, F.R.C.V.S., Holliday  
Street Wharf, Birmingham.  
HARRY MOORE, M.R.C.V.S., Worksop,  
Notts.  
JOHN M. PARKER, M.R.C.V.S., 40  
Cannon Street, Birmingham.  
Professor PENBERTHY, F.R.C.V.S.,  
Royal Veterinary College, Camden  
Town, N.W.  
CLEMENT STEPHENSON, F.R.C.V.S.,  
Sandyford Villa, Newcastle-on-  
Tyne.

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**OFFICIAL REPORTER.**

W. FREAM, B.Sc., LL.D., 18 Hanover Square, London, W.

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**YORK MEETING, 1900.****Closing of Entries for Live Stock, Poultry, and Farm Produce.**

Exhibitors are reminded that the FINAL DATES for the receipt of  
ENTRIES for the York Meeting will be as under :—

**LIVE STOCK (Horses, Cattle, Sheep, Pigs) :—**

MONDAY, APRIL 16, 1900, at 10s. per Entry.  
TUESDAY, MAY 1, at 15s. per Post Entry.  
TUESDAY, MAY 15 (last day), at £1 per Late Entry.

**POULTRY AND FARM PRODUCE :—**

TUESDAY, MAY 1, 1900, at 2s. 6d. per Entry.  
TUESDAY, MAY 15 (last day), at 5s. per Post Entry.

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Double Fees throughout to Non-Members of the Society.

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# PRINCIPAL ADDITIONS TO THE LIBRARY DURING THE YEAR 1899.

[The name of the Donor, or the mode of acquisition, appears in *Italics*  
after the title of each work.]

- ADEANE, C., and Carr, Richardson, Agricultural Handbook and Diary, 1900.  
8vo. London, 1899 ..... *Publishers*
- BATH and West of England Society, Journal. 4th ser. Vol. IX. 8vo.  
London, 1898-9 ..... *Society*
- Bell, Sir William J., and Scrivener, H. S., The Sale of Food and Drugs Acts,  
1875-99. 8vo. London, 1900 ..... *Publishers*
- Bolton, H. C., Select Bibliography of Chemistry. (First Supplement.) 8vo.  
Washington, 1899 ..... *Smithsonian Institution*
- Boys, John, General View of the Agriculture of Kent. 8vo. London, 1796.  
..... *Purchased*
- Bride, Thos. F., Letters from Victorian Pioneers. 8vo. Melbourne, 1899.  
..... *Trustees of Public Library, Melbourne*
- Bright, Tom, Principles and Practice of Timber Measuring. 8vo. London.  
N.D. .... *Publishers*
- Burder, B. E. C., Agricultural Essays. 8vo. Shaftesbury, N.D. .... *Author*
- CLARKE, A. Dudley, Modern Farm Buildings: Their Construction and  
Arrangement. 3rd ed. 8vo. London, 1899 ..... *Author*
- Colombo, A., Le Lecanium Hesperidum. 8vo. Cairo, 1899 ..... *Author*
- Cornell University, Bulletins of the Agricultural Experiment Station. 8vo.  
Ithaca, 1899 ..... *University*
- Crookes, Sir Wm., The Wheat Problem. 8vo. London, 1899 ..... *Purchased*
- DE SAPOITA, A., Physique et Chimie Viticoles. 8vo. Paris, 1899 ... *Editors*
- Dymond, T. S., Experimental Course of Chemistry. 8vo. London, 1899.  
..... *Author*
- Report on Visit of Essex Agriculturists to Holland. 8vo. Chelmsford,  
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- "FARMER, A," Essays Relating to Agriculture. 8vo. Edinburgh, 1775.  
..... *Purchased*

## *Flock-Books :—*

- Cheviot Flock-Book. Vol. VIII. 8vo. Hawick, 1899 ..... *Society*
- Hampshire Down Flock-Book. Vol. X. 8vo. Salisbury, 1899 ..... *Assocn.*
- Kent or Romney Marsh Flock Book. Vol. V. 8vo. London, 1899 ... *Society*
- Leicester Flock-Book. Vol. VII. 8vo. Leeds, 1899 ..... *Assocn.*
- Lincoln Long-Wool Flock-Book. Vol. VIII. 8vo. Lincoln, 1899 *Assocn.*
- Oxford Down Flock-Book. Vol. XI. 8vo. Oxford, 1899 ..... *Society*
- Roscommon Flock-Book. Vol. IV. 8vo. Dublin, 1899 ..... *Assocn.*
- Southdown Flock-Book. Vol. VIII. 8vo. Lewes, 1899 ..... *Society*
- Suffolk Sheep Society Flock-Book. Vol. XIII. 8vo. Bury St. Edmunds,  
1899 ..... *Society*
- Wensleydale Blue-Faced Sheep Flock-Book. Vol. X. sm. 8vo. Hawes,  
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- Wensleydale Long-Wool Sheep Flock-Book. Vol. X. 8vo. Bedale, 1899  
..... *Assocn.*
- Floyd, Marcus L., Cultivation of Cigar-Leaf Tobacco in Florida. 8vo.  
Washington, 1899 ..... *U.S.A. Dept. of Agriculture*



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- NATIONAL Poultry Conference, Official Report.** 8vo. London, 1899.  
*Honorary Secretaries*  
**Newman, G., Bacteria, as Related to the Economy of Nature, to Industrial Processes, and to the Public Health.** 8vo. London ..... *Publishers*  
**New South Wales, Wealth and Progress of, 1897-8.** By T. A. Coghlan. 8vo. Sydney, 1899 ..... *Agent-General*  
**Newstead, R., General Index to Reports on Insects.** 8vo. London, 1899.  
*Miss Ormerod*  
**North Carolina Agricultural Experiment Station Report, 1898-9.** 8vo. Raleigh, 1899 ..... *Station*
- ONTARIO, Annual Report of Department of Agriculture for 1898.** 2 vols. 8vo. Toronto, 1899 ..... *Department*  
**Ormerod, E. A., Twenty-second Report of Observations on Injurious Insects.** 8vo. London, 1899 ..... *Author*
- PALGRAVE, R. H. Inglis, Dictionary of Political Economy.** Vol. III., N-Z. 8vo. London, 1899 ..... *Purchased*

## Parliamentary Papers:—

- Agricultural Returns for 1898.** 8vo. London, 1899... *Board of Agriculture*  
**Agricultural Returns, Abstract for 1899.** 8vo. London, 1899.  
*Board of Agriculture*  
**Agricultural Statistics of Ireland for 1898.** Fol. Dublin, 1899.  
*Irish Land Commission*  
**Annual Statement of the Trade of the United Kingdom.** Fol. London, 1899.  
*Board of Trade*  
**Board of Agriculture, Annual Report of Distribution of Grants, 1898-9.** 8vo. London, 1899 ..... *Board*  
**Glanders Committee, Minutes of Evidence and Report.** Fol. London, 1899 ..... *Board of Agriculture*  
**Irish Land Commission, Prevention of Potato Disease: Spraying Instructions.** 8vo. Dublin, 1899 ..... *Commission*  
**— Return of Prices of Irish Agricultural Produce for 1881-98.** Fol. Dublin, 1899 ..... *Purchased*  
**Report by Her Majesty's Representatives Abroad on Bounties.** 8vo. London. *Purchased*  
**Report of Results of Investigations into Cheddar Cheese-making.** 8vo. London, 1899 ..... *Board of Agriculture*  
**Reports from Colonies on Bounties.** 8vo. London, 1896..... *Purchased*  
**Report of Irish Land Commissioners for 1898-9.** Fol. Dublin, 1899.  
*Commission*  
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**Statistical Abstract for Colonial and other Possessions.** 8vo. London, 1899.  
*Board of Trade*  
**Statistical Abstract for the United Kingdom.** 8vo. London, 1899.  
*Board of Trade*
- Petty, Sir William, Economic Writings.** Edited by C. H. Hull. 2 vols. 8vo. Cambridge, 1899 ..... *Purchased*  
**Pommer, Dr. E. Jahresbericht über die Erfahrungen und Fortschritte auf dem Gesamtgebiete der Landwirtschaft, 1898.** 8vo. Braunschweig, 1900 ..... *Purchased*  
**Poore, G. V., Milroy Lectures on the Earth in Relation to Contagia.** 8vo. London, 1899 ..... *Author*
- QUEENSLAND, Annual Report of Department of Agriculture for 1897-8.** 8vo. Brisbane, 1898..... *Department*

# 12 *Principal Additions to the Library during the Year 1899.*

ROUSIERS, Paul de, *La Vie Américaine, Ranches, fermes, usines.* 12mo. Paris. N.D. .... *Purchased*

SAHUT, Felix, Charles Naudin (Biography). 8vo. Montpellier, 1899... *Author*

— Découverte du Phylloxera. 8vo. Montpellier, 1899 ..... *Author*

Smithsonian Institution, Annual Report of the Board of Regents. 8vo. Washington, 1898 ..... *Institution*

Somerville, Prof. Wm., Seventh Annual Report on Experiments with Crops and Stock in Cumberland, Durham, and Northumberland. 8vo. London, 1898 ..... *Author*

Stillich, Dr. Oskar, *Die Englische Agrarkrisis.* 8vo. Jena, 1899... *Purchased*

## *Stud-Books :—*

Clydesdale Horse Stud-Book. Vol. XXI. 8vo. Glasgow, 1899 ... *Society*

Hackney Horse Stud-Book. Vols. XVI.-XVII. 8vo. London, 1899-1900 *Society*

Hunters' Improvement Society, Record of Mares and Sires. Vol. VIII. 8vo. London, 1900 ..... *Society*

Polo Pony Stud-Book. Vol. V. 8vo. Lewes, 1899. .... *Society*

Shire Horse Stud-Book. Vol. XX. 8vo. London, 1899 ..... *Society*

Yorkshire Coach Horse Stud-Book. Vol. VI. 8vo. York, 1899. ... *Society*

TAUNTON, W. K., *The Pedigree Record.* 3 vols. 8vo. London, 1899. *Publishers*

Tegetmeier, W. B., *The House Sparrow.* 8vo. London, 1899 ..... *Publishers*

Theobald, F. V., *Text-Book of Agricultural Zoology.* 8vo. Edinburgh and London, 1899..... *Publishers*

Thiel, Dr H., *Landwirthschaftliches Jahrbuch.* Vol. XXVIII. 8vo. Berlin, 1899 ..... *Author*

Thompson, J. L., *Collection of Tracts on Agricultural Subjects.* 8vo. Sydney, 1894-8 ..... *Author*

UNITED States Department of Agriculture, *Notes on Plant Products of Philippine Isles.* 8vo. .... *Department*

— Year Book, 1898. 8vo. Washington, 1899 ..... *Department*

VERSNICK, L., *Tableau de l'Economie Rurale.* 8vo. Gand, 1900. *Paul de Vuyst*

Vinton's Agricultural Almanac, 1900. 4to. London, 1899..... *Publishers*

WARINGTON, R., *Lectures on Some of the Physical Properties of Soil.* 8vo. Oxford, 1900 ..... *Publishers*

Wildman, Thomas, *Peach Trees; to which is added, The Management of Bees.* 8vo. London, 1778 ..... *Purchased*

Wölbling, Berthold, *Der erste Rundgang der landwirtschaftlichen Wanderausstellungen in Deutschland.* 8vo. Berlin, 1899 ..... *Author*

Wood, Sir H. T., *Commercial Education in England.* 8vo. London, 1899. *Author*

ZOOLOGY, *Proceedings of Fourth International Congress.* 8vo. London, 1899. *Hon. Secretaries*

*The Society is indebted to numerous Government Departments, both at home and abroad, to Boards of Agriculture, Agricultural Societies, and kindred institutions, for copies of their Annual Reports, Journals, Proceedings, Transactions, Bulletins, and other documents received regularly for the Library in exchange for copies of the Journal, as well as to the Editors of many agricultural and general papers for the current numbers of their publications, which have been placed for reference in the Reading Room.*

# ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

## Proceedings of the Council.

WEDNESDAY, APRIL 4, 1900.

THE EARL OF COVENTRY (EX-PRESIDENT) IN THE CHAIR.

### Present :

*Trustees.*—Colonel Sir Nigel Kingscote, K.C.B., the Duke of Richmond and Gordon, K.G., Earl Spencer, K.G., Sir John H. Thorold, Bart.

*Vice-Presidents.*—The Earl of Feversham, the Earl of Coventry, the Rt. Hon. Sir Massey Lopes, Bart., the Hon. Cecil T. Parker, Sir Jacob Wilson.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. Alfred Ashworth, Mr. R. C. Ascheton, Viscount Baring, Mr. J. Bowen-Jones, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Col. Curtis-Hayward, Mr. A. E. W. Darby, the Earl of Derby, K.G., Mr. J. Marshall Dugdale, Mr. William Frankish, the Marquis of Granby, the Earl of Jersey, G.C.M.G., Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. P. A. Muntz, M.P., Mr. Albert Pell, Mr. Frederick Reynard, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Henry Smith, Mr. E. W. Stanyforth, Mr. Martin J. Sutton, Mr. Garrett Taylor, Mr. R. A. Warren, Mr. C. W. Wilson.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. Cecil Warburton, Zoologist; Mr. F. S. Courtney, Consulting Engineer; Mr. J. E.

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Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, O.B.; Professor McFadyean.

The following members of the York Local Committee were also present:—The Lord Mayor of York (Mr. Alderman G. Sykes Rymer), the Sheriff of York (Mr. Arthur Jones), Mr. Alderman McKay, Mr. J. J. Hunt, Mr. W. H. Andrew, and Mr. Francis E. Walker.

Apologies for non-attendance were received from Earl Cawdor, Lord Brougham and Vaux, Lord Moreton, Sir Walter Gilbey, Bart., Mr. George Blake, Mr. H. Chandos-Pole-Gell, Mr. James Hornsby, Mr. J. E. Ransome, Mr. S. Rowlandson, Mr. A. J. Smith, Mr. J. P. Terry, Mr. E. V. V. Wheeler, and Mr. Charles Whitehead.

At the opening of the proceedings, Sir NIGEL KINGSCOTE said that he was desired to express the regrets of H.R.H. the Prince of Wales that he was unable, owing to his journey to Denmark, to take the chair that day as their President.

Accordingly, on the motion of Sir NIGEL KINGSCOTE, the Earl of Coventry, as ex-President, was called to the chair.

The minutes of the Special Meeting of the Council held at 11 a.m. on March 7, 1900, were read and confirmed, and the minutes of the last Ordinary Meeting of the Council, held at 12 noon on the same date, were read and approved.

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**Death of a Member of Council.**

The CHAIRMAN said it was his painful duty to report officially to the Council that there was a vacancy in their body caused by the lamented death, at Assouan, on March 13 last, of Mr. Dan Pidgeon. Mr. Pidgeon had rendered the Society very conspicuous services in a variety of capacities during the thirteen years of his association with it; first as a judge of implements, and, after his election on the Council, as a member of the Journal and Implement Committees, and also as the contributor of a number of very interesting and attractively written articles in the Journal. He was sure that all those who had had the privilege of working with Mr. Pidgeon would recognise that they had lost in him a very valuable and able colleague.

**Election of New Members.**

The election of the following twenty-seven members was then proceeded with:—

AARON, Mrs. S. M...Park Grounds, Ousefleet, Goole.  
 BICKERTON, Henry N...Wellington Works, Ashton-under-Lyne.  
 BRADLEY, Henry W...Wellington Works, Ashton-under-Lyne.  
 BRAMHILL, J...Empson Farm, Holdenby, Goole.  
 BRUNYER, Wm...Booth Ferry House, Goole.  
 CRABTREE, James...39 Price Street, Birkenhead.  
 CUNDALL, J. S...Alredale Ironworks, Shipley, Yorks.  
 DIMSDALE, Hon. Baron...Kensendon, Hatfield.  
 DREW, Julius C...Wadhurst Hall, Sussex.  
 EAST AND WEST RIDING JOINT AGRICULTURAL COUNCIL...County Hall, Wakefield.  
 FENWICK, Lancelot...Brinkburn Priory, Pauperhaugh R.S.O., Northumberland.  
 HARGREAVES, Frank...Halford Manor, Shipston-on-Stour.  
 HAY, Alexander...Bon Accord Works, Aberdeen.  
 HOLDRIDGE, Lewis...Goole Fields, Goole.  
 HUMPHRIES, O. G...Atlas Works, Pershore.  
 INNES, Ernest...Roffey Park, Horsham.  
 LAMIN, William...Bestwood Park, Arnold, Notts.  
 MONTGOMERY, Hugh...160 Princes Road, Liverpool.  
 PHIPPS, Pickering...Rushton Hall, Kettering.  
 POOSON, Frank...Redmile, Bottesford, Notts.  
 SCHOLES, Walter...Wellington Works, Ashton-under-Lyne.  
 SIMONDS, W. Barrow, jun...Waterside, near Winchester.  
 SMITH, George...Manor House, Wilford, Notts.  
 SYKES, Robert...Pasture Farm, King's Causeway, Goole.  
 SYKES, Robert J...Sand Hill Farm, King's Causeway, Goole.  
 TEMPLE, Joseph...Aberaman, Glamorganshire.  
 THISTLEWOOD, George W...Crowle, Doncaster.

The reports of the various Standing Committees were presented and adopted as below:—

**Finance.**

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the month ended March 31, 1900, as certified by the Society's Accountants, showed total receipts amounting to 5,165*l.* 11*s.* 9*d.*, and expenditure amounting to 4,324*l.* 12*s.* 7*d.* Accounts amounting in all to 3,436*l.* 13*s.* 5*d.* had been passed and were recommended for payment. The Committee had considered the question of the issue of books of tickets for admission to the Shows and recommended that books be issued, under the control of the Secretary, of ten tickets for 1*l.* admitting on the half-crown days, and twenty-five tickets for 1*l.* admitting on the shilling days. The quarterly statement of subscriptions, arrears, and property, as at March 31, 1900, was laid upon the table.

**House.**

Sir NIGEL KINGSCOTE (Chairman) also presented a report from this Committee as to matters connected with the Society's house.

**Journal.**

Sir JOHN THOROLD (Chairman) reported the publication of the March number of the Journal, which was in course of issue to the members. The contents of the next number had been discussed, together with various suggestions for articles and notes, and directions had been given to the Editor thereon.

**Chemical and Weburn.**

Mr. STANYFORTH (Chairman) reported that the Committee had approved the details of a scheme prepared by the Consulting Chemist for certain experiments in the feeding of calves. Mr. Dugdale had very kindly consented to allow the experiments to be conducted on his estate in North Wales, and the thanks of the Council were due to him for the facilities thus offered. The Committee asked the Council to

place at their disposal a sum not exceeding 50*l*. for the incidental expenses connected with these experiments. The Committee recommended that Dr. Voelcker should be appointed to fill the vacancy caused by the retirement of Earl Cawdor as one of the Society's representatives upon the Lawes Agricultural Trust Committee.

Mr. STANYFORTH having formally moved that Dr. Voelcker be appointed a representative of the Society upon the Lawes Agricultural Trust Committee,

Sir JOHN THOROLD, in seconding the motion, said that, as the other representative of the Society upon the Lawes Trust, he had felt for some years that it would be a great advantage if the Society were represented by a professional man. Difficult questions often came before the Committee of the Trust that required the assistance of an expert, and it would be a considerable gain if the Committee could have the advantage of Dr. Voelcker's services.

The appointment of Dr. Voelcker was then unanimously agreed to.

#### *Order Forms for Fertilisers, &c.*

Mr. STANYFORTH said that the Chemical Committee had no report from the Consulting Chemist to present on that occasion; but there were two lengthy reports last time, which appeared amongst the Official Reports in the Society's Journal. He desired to direct special attention to the report of the Chemical Committee appearing at page 87 of Part I. of the current volume of the Journal, as it was one which would be of great interest to every agriculturist. In that report the more extended use had been urged of the Order Forms for fertilisers and feeding stuffs prepared by the Society for the convenience of its members. These forms had not hitherto been used to the extent the Chemical Committee could desire. Although such forms did not in themselves furnish a legal guarantee to the purchaser, where they had been utilised they had undoubtedly acted as a deterrent to manufacturers

and vendors. The Chemical Committee had recently revised these Order Forms, and invited the Council to assist them in the matter. He was perfectly certain that if they could induce the members of the Society to use these forms, they would be going a long way towards preventing fraud by the sale of comparatively worthless materials.

#### *Botanical and Zoological.*

Mr. ASHWORTH (in the absence of Mr. E. V. V. Wheeler, Chairman) reported that it was proposed to keep certain of the plots of grass experiments under observation during the year 1900, and that the experiments in the eradication of weeds, which had been commenced last year, were being continued. The Consulting Botanist had been asked to consider whether it would be possible for the Society to issue Order Forms for seeds similar to those issued by the Chemical Committee for Fertilisers and Feeding Stuffs, and to report to the Committee thereon.

The Zoologist had presented the following report:—

Insects have as yet shown no great activity, and most of the applications received by the Zoologist have had reference to such perennial pests as grain weevils, wood-boring beetles, and wire-worm.

Infested grain is best treated by bisulphide of carbon in a closed bin. One pound of the fluid sprinkled on the surface of the grain is sufficient for the treatment of a hundred bushels, but caution must be exercised in its use, as it is highly inflammable, and it is dangerous to bring a naked light near the bin until some hours after opening it.

Some insects alleged to be injuring sealaks were sent for identification, and proved to be the grubs of the dung beetle (*Geotrupes*). This is ordinarily quite harmless, so that some other cause of the injury was suspected, and on more careful search several surface caterpillars—the larvae of *Noctua* moths—were discovered in the soil.

Considerable damage to wooden fixtures in buildings was found to be due to the boring beetle *Annobium Truncellatum*, an insect closely allied to the better known "Death Watch."

(Signed) CECIL WARBURTON.

April 3, 1900.

#### *Purity of Seeds.*

Mr. ASHWORTH, in presenting this report, said his Committee had discussed the question of Order Forms, and he fully endorsed what Mr. Stanyforth had said. It would be a

great advantage if some such certificate could be provided for the members of the Society in the purchase of seeds.<sup>1</sup> Mr. Carruthers had expressed the opinion that the Botanical Committee of that Society had done most valuable work in the direction of improving the purity of seeds. Twenty years ago Mr. Carruthers had only been able to insist upon 40 per cent. germinating power in the case of certain grasses, whereas at the present time it had risen to 80 per cent., a result attributable in no small degree to the energy of the Botanical Committee.

### Veterinary.

The Hon. CECIL T. PARKER (Chairman) reported that the Committee had further considered the situation created by the city of York being still a "swine fever infected area," under the Order of the Board of Agriculture, dated January 26, 1900; and to provide for the possible event of the present restrictions being removed before the date of their next meeting on May 1, the Committee recommended that no final decision in the matter be arrived at by the Council until then. If on May 1 the city of York should still be an infected area, the contemplated exhibition of pigs at the York Meeting would of necessity have to be abandoned; but if meanwhile the existing order should be rescinded by the Board of Agriculture, the Secretary would be authorised to receive provisionally entries of pigs for the prizes offered by the Society, subject, of course, to any restrictions which might be in force at the time of the Show. To meet the convenience of exhibitors who were at present placed in a position of uncertainty in the matter, the Committee recommended that any entries of pigs which it might be found possible to accept should be received up to May 15 at the ordinary rates.<sup>2</sup>

The Committee had had under consideration the question of milk sterilisation and Pasteurisation with a view to the destruction of tubercle bacilli in milk, and recommended the

publication in the Proceedings of the Council of the following memorandum, which had been drawn up by a Sub-Committee, consisting of Professor Sir George Brown, Professor McFadyean, and Mr. Harold Swithinbank:—

The Committee consider it desirable that the public should be warned that the process of Pasteurisation, which consists in raising the milk for a period more or less prolonged to a temperature of about 160 deg. Fahr., cannot be relied upon to remove all danger from tuberculous milk as an article of food for either men or animals.

In the experiments which have been carried out of late years two facts have been brought to light—the one, that raising infected milk to boiling point renders it perfectly harmless; the other, that raising such milk to a temperature not exceeding 176 deg. Fahr. leaves it still in a dangerous condition, and capable of infecting animals.

The Report of the Royal Commission on Tuberculosis is conclusive upon this point.

Whilst, however, boiling milk may be looked upon as the safest method of securing the end in view, it has been held by good authorities that a temperature of 185 deg. Fahr. is sufficient for the purpose if maintained for a period of ten minutes.

But this view is now modified by the recent experiments of Galtier (*Journal de Médecine Vétérinaire*, January, 1900), who claims to have killed guinea-pigs with tuberculous milk after exposure to a temperature of 185 deg. Fahr. for six minutes.

In any case, no temperature less than 185 deg. Fahr. can be looked upon as safe.

Professor McFadyean had presented to the Committee the following report:—

**ANTHRAX.**—During the first twelve weeks of this year 127 outbreaks, with 192 animals attacked, have been reported. The corresponding figures for last year were 193 and 223 respectively.

**FOOT-AND-MOUTH DISEASE.**—No case of this disease had been detected since the third week of February, but cases suspected to be of this disease have been detected in Argentine cattle landed at Deptford this week.

**GLANDERS.**—The outbreaks reported during the first twelve weeks of this year number 336, and the animals attacked 448, as against 163 outbreaks and 309 animals attacked during the corresponding period of last year.

**RABIES.**—No case of this disease has been notified since December last.

**SWINE FEVER.**—The weekly returns continue to show a sensible decline in the prevalence of this disease. During the first twelve weeks of this year 400 outbreaks have been reported, as against 548 in the corresponding period of last year.

**MISCELLANEOUS.**—The number of morbid specimens forwarded to the Research Laboratory at the Royal Veterinary College for examination during the month of March was forty-eight, comprising cases of glanders, anthrax, tuberculosis, calf-diphtheria, diseases caused by worm parasites, &c.

<sup>1</sup> See p. lxvii.

<sup>2</sup> See p. lxvii.

Mr. ASHWORTH considered the pronouncement of the Veterinary Committee with regard to milk sterilisation very important, and he hoped general attention would be drawn to it, in view of the erroneous statements which had appeared as to this matter in the public press.

#### *Foot-and-mouth Disease.*

Earl SPENCER asked if there was any further information available as to the origin of the outbreak of foot-and-mouth disease in the Eastern Counties, which had recently been the subject of discussion in the Council.

Sir GEORGE BROWN regretted to say that the Board of Agriculture had not been able to trace the origin of this outbreak; but unhappily he had some very exact information as to recent cases of the disease which had been recognised on board a cargo ship from the Argentine, which had arrived at Deptford. On the arrival of a vessel carrying 210 head of cattle from the Argentine, the inspectors had found more than half the animals suffering from foot-and-mouth disease in its most virulent form. There were at that time on the ocean other cattle ships from the Argentine on their way to England, and it was to be feared that further cases of foot-and-mouth disease might exist on these vessels also. The difficulty was that if an Order were issued prohibiting the landing of the animals in question at Deptford, they would only go on somewhere else. It had therefore been decided that it would be wiser to have the animals landed at Deptford and to take every possible precaution in slaughtering them. He need hardly say that this was being done, and that the Board of Agriculture were fully alive to the gravity of the situation. But while the Board was chiefly concerned in notifying local bodies, the Royal Agricultural Society was more concerned in warning individual farmers to be upon their guard, and to watch for the appearance of any symptoms of this disease. These, although perfectly familiar to the older members of the Society, would not be so well known

to the younger generation of agriculturists. The first signs of an attack were dullness of the animal, a peculiar smacking or sucking noise made by the lips, followed by a discharge of saliva from the mouth (commonly described as "slavering"), shifting the feet, and a very characteristic symptom—kicking with one of the hind feet alternately as though something were between the claws which the animal was trying to get rid of. These signs should lead the attendant to examine the animal's mouth, and on the slightest appearance of vesicles or blisters, it might be taken as highly probable that the animal was suffering from the disease—at any rate, there was ground for strong suspicion; and the case should be reported.

In reply to an inquiry by Mr. PELL, Sir JACOB WILSON said that perhaps he might be allowed to add to what had been stated by Sir George Brown, that the Board of Agriculture had received intimation that foot-and-mouth disease was believed to have broken out in Argentina, and had in consequence been watching carefully all the ports at which cargoes of cattle and sheep brought from that country might arrive. On April 2 last the Board's Inspectors discovered the disease in a cargo of animals which had arrived on that day, and they forthwith issued an Order prohibiting the landing in Great Britain of all animals brought from the country of the Argentine Republic or from Uruguay, these countries being in effect added by the Order to the list of "prohibited countries" scheduled to the Foreign Animals Order of 1896. To meet the case of cargoes already on the sea, this Order would not come into operation until April 30; but he could assure the Council that no precaution would be omitted by the Board in dealing with any such cargoes as might meanwhile be landed in this country, and, of course, in any case no animal would be permitted to leave the Foreign Animals' Wharf alive.

The CHAIRMAN said that the information which had been given by Sir George Brown was of a very valuable character, and it would be of great advantage to the agriculturists of this country in putting

them on the alert against this dreaded disease.

### Stock Prizes.

Mr. SANDAY (Chairman) reported that inquiries having been received as to whether animals entered in Class 46 (Ponies 13 h. 2 in., and not exceeding 14 h. 2 in. in height), and in Class 47 (Ponies under 13 h. 2 in. in height), were to be shown in hand or under saddle, the Committee recommended that intending exhibitors should be informed that the animals entered in Classes 46 and 47 at the York Meeting are to be ridden. The Secretary having reported that the city of York was still a "swine fever infected area," under Order 6018, issued by the Board of Agriculture on January 26 last, the Committee had remitted to the Veterinary Committee the question as to whether, under these circumstances, it was desirable to have an exhibition of pigs at York.

Mr. C. W. Wilson's name had been added to the Committee.

On the motion of Mr. SANDAY, was resolved that the sum of 5,000*l.* be placed at the disposal of the Stock Prizes Committee for providing prizes for live stock, poultry, produce, &c., at the Cardiff Meeting of 1901.

### Judges Selection.

Mr. SANDAY (Chairman) reported that the list of judges for the York Meeting had been published in the current number of the Society's Journal, issued on March 31. The Committee had made a selection, from the list of judges, of umpires to act in cases of necessity.

### Implement.

Mr. FRANKISH (Chairman) reported that the Allotment Committee had met on Monday, April 2, and had arranged the positions of the stands in the Implement Department of the York Meeting. The amount of space which had been allotted in the several departments (excluding open ground space) was as follows:—

Ordinary Shedding . . .	9,454 feet.
Special . . .	2,771 "
Machinery in Motion . . .	2,547 "
Total . . .	14,772 "

### Showyard Works.

Sir JACOB WILSON (Chairman) reported that about 6,000 ft. of implement shedding had been erected, the frame-work of the grand stand and of the Dairy were completed, and accommodation had been provided for about 500 horses. The erection of the Stewards', Members' and Royal pavilions was in a forward state. The Local Committee had laid sleeper roads up to the main entrance, and to the machinery entrance, and the return road was being constructed. Instructions had been given on various points connected with the arrangements for the supply of refreshments, and other matters connected with the York Showyard.

### Selection.

Sir JOHN THOROLD (Chairman) presented the recommendation of this Committee as to the nomination of a new Member of Council in the room of the Hon. Cecil Parker, elected a Vice-President.

### General York.

The Earl of FEVERSHAM reported that the Committee had had under consideration a draft programme of the York Meeting. It had been decided to open the Implement yard to the public on Saturday, June 16, on payment of 2*s.* 6*d.* for admission, and the entire showyard would be opened on Monday, June 18, the charge for admission to be 5*s.* each person. On the Tuesday and Wednesday of the show the charge for admission would be 2*s.* 6*d.* each, and 1*s.* on the Thursday and Friday. The necessary arrangements were being made for the service for the herdsmen and others in the showyard on Sunday, June 17. A military band would be engaged to play in the showyard during the week of the Show, with the exception of the opening day, Monday, when the judging of the live stock and poultry would take place. The York Local Committee had arranged the cab and omnibus fares between the railway station and the showyard. The charge for a cab would be 2*s.* for one or two persons, with an additional 1*s.* for each extra person, the

maximum fare not to exceed 4s. The omnibus fare would be 6d. for each person.

### **Education.**

Mr. BOWEN-JONES reported the receipt of the following reply from the Board of Education to the letter which had been addressed to the Department, conveying the resolution passed by the Education Committee at their meeting held on March 6 last, "that in rural elementary schools the instruction be adapted to the requirements of country life."

Education Department,  
Whitehall, S.W.  
March 26, 1900.

Sir,—Adverting to your letter dated the 13th instant, I am directed to state that one of the objects of the alterations introduced into the Code for 1900, which has now been presented to Parliament, is to give managers and teachers increased freedom in adapting the courses and methods of instruction in their schools to local requirements.

I am to enclose herewith a copy of the new Code, and to invite the attention of your Council to Articles 15, 98 (a), 101 (a) (i) (a), and 101 (a) (ii). The specimen schemes of instruction mentioned in the last-named Article will be issued shortly.

I am to inquire whether, looking to the changes made in the Code, your Council still desire that My Lords should receive the deputation proposed in your letter.—I am, &c.,  
(Signed) G. W. KKKKWWICH.

The Secretary,  
Royal Agricultural Society.

Having considered this letter, the Committee were of opinion that it would not be necessary to trouble the Board of Education with a deputation on the subject. The Committee also reported that fifty-three entries had been received for the first examination for the National Diploma in Agriculture, to take place from April 30 to May 4 in the Great Hall of the Yorkshire College at Leeds.

### **Dairy.**

Mr. DUGDALE (Chairman) reported that several entries of dairy appliances "new implements" had been made for the York Meeting.

### **Special Show Committee.**

The Hon. CECIL T. PARKER (Chairman) presented the following further report from this Committee:—

1. The Committee held a meeting on Monday, April 2, to

consider the subject of the further reference made to them by the Council at its last meeting. Inquiries have meanwhile been prosecuted in various directions as to localities in which sites for a permanent showyard for the Society might possibly be found; and the Committee have given directions for these inquiries to be continued.

2. Letters and resolutions have been received from various Corporations and other bodies, urging the claims of their towns to consideration, and the Committee have reason to believe that other places are also moving in the matter.

3. It would be impossible, of course, for the Society to consider such proposals in detail without knowing whether in the towns in question there are sites available; the Committee would be obliged by notifications being sent to them, from any quarter, of sites which fulfil the requirements which they indicated in their report of February 5, 1900.<sup>1</sup>

4. It would be an advantage from the point of view of future development that any such site should not be less than 150 acres in extent, and it must be within walking distance of the centre of a town and of a large railway station. It is, perhaps, unnecessary to say that the Committee regard the convenience of railway facilities to the town from the several parts of England as most important.

5. It is not absolutely essential that all the site should be at this moment under pasture, though it would be an advantage if it were. A considerable part of it ought in any case to be old sward land. The site should be level and well drained, and approachable by good roads with easy gradients. The proximity of existing gas and water supplies are also points that will have to be considered.

6. The Committee think it may be possible that in connection with schemes for the development of some of the larger towns or boroughs, arrangements might be made whereby an area could be

<sup>1</sup> See Part I. pp. 65-66.

made available for the use of the Society for at least two months of the year for the purposes of its annual show, such area being utilised for other purposes during the remainder of the year.

7. In view of the undoubted advantages which would accrue to any town from its selection as the site of the Society's permanent showyard, the Committee think the Council may rely with some confidence upon the assistance of the local Corporations and other bodies in arranging the preliminaries; and undoubtedly the best method of all would be for the Society to be placed in the position of renters, for a limited period of the year, of the ground selected, rather than it should have any responsibilities for the purchase of the land or its up-keep and management during the whole of the year.

(Signed) CECIL T. PARKER,  
Chairman.

April 2, 1900.

After some general discussion, this report was adopted.

### Retiring Members of Council.

The following list was prepared of the twenty-four Members of Council who retire by rotation, and are eligible for re-election, showing the number of attendances at Council and Committee meetings of each of such members during the past two years, in accordance with the subjoined sections of Bye-law No. 23:—

(a) A list of the Members of Council who retire by rotation, but are desirous of re-election, showing the number of attendances at Council and Committee meetings of each of such members during the two years ended the previous March, shall be prepared at the April Council, and published immediately in at least two agricultural papers. (b) No Member of Council who does not attend at least two Council meetings in each of the two years for which he is appointed shall be eligible for re-election. (c) Any two Governors or Members may nominate in writing to the Secretary, before May 1 following, a member or members of the Society desirous of being nominated for election on the Council; these nominations, with the names of the proposer and seconder, shall also be added to the previously published list, and the entire list shall be published in the same

agricultural papers immediately after the May Council, and be also printed for the use of members at the General Meeting in May.

Attendances at Meetings of Council and Committees from April, 1898, to March 1900, inclusive	Council Meetings. Total number, 18	Committees	
		No. of Meetings	Attendances
ARKWRIGHT, J. H. . . .	10	83	48
BLAKE, GEORGE . . . .	9	8	—
BROUGHAM AND VAUX, Lord . . . . .	10	52	28
CAVENDISH, VICTOR C. W., M.P. (elected May 23, 1898) . . . .	9	22	7
CECIL, Lord ARTHUR (elected Dec. 7, 1898) . . . . .	9	21	14
CURTIS-HAYWARD, Lt.-Col. . . . .	16	80	45
FOSTER, S. P. . . . .	7	24	10
FRANKISH, WILLIAM . . . .	14	119	76
GRANBY, Marquis of . . . .	8	—	—
GRENVILLE, R. NEVILLE . . . .	9	48	25
HORNSBY, JAMES . . . . .	14	47	26
LEVETT, Capt. W. S. B. . . .	16	73	60
MARSHALL, HENRY D. . . .	14	16	15
MUNTZ, P. A., M.P. . . . .	8	—	—
RANSOME, JAMES E. . . . .	16	49	20
ROGERS, CHARLES COLTMAN . . . . .	13	45	28
RYLAND, HOWARD P. . . . .	12	68	54
SANDAY, GEORGE H. . . . .	16	87	71
SMITH, HENRY . . . . .	10	30	11
STRATTON, RICHARD . . . .	8	—	—
SUTTON, MARTIN J. . . . .	15	53	44
WARREN, R. A. . . . .	13	16	13
WHINKLER, E. V. V. . . . .	17	85	66
WILLIAMS, J. C. . . . .	8	24	9

For the vacancy upon the Council caused by the death of Mr. Dan Pidgeon, whose period of office would have expired at the General Meeting, Mr. HENRY D. MARSHALL handed in a formal nomination in writing by Mr. Frankish and himself of Mr. R. W. Eddison, of The Manor, Adel, Leeds, as a member of the Council.

### Country Meeting of 1901.

On the motion of Mr. Sanday, seconded by Mr. Crutchley, the seal of the Society was ordered to be affixed to the Agreement with the Corporation of Cardiff for the holding of the Country Meeting of 1901 in that town.

Other business having been transacted, the Council adjourned until Wednesday, May 2, 1900, at noon.

WEDNESDAY, MAY 2, 1900.

EARL SPENCER, K.G. (TRUSTEE), IN THE CHAIR.

**Present:**

*Trustees.*—Earl Egerton of Tatton, Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., Earl Spencer, K.G., Sir John H. Thorold, Bart.

*Vice-Presidents.*—The Earl of Feversham, the Rt. Hon. Sir Massey Lopes, Bart., Lord Moreton, the Hon. Cecil T. Parker, Mr. Charles Whitehead, Sir Jacob Wilson.

*Other Members of Council.*—Viscount Baring, Mr. George Blake, Mr. J. Bowen-Jones, Lord Brougham and Vaux, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut. Colonel Curtis-Hayward, the Earl of Derby, K.G., Mr. J. Marshall Dugdale, Mr. Hugh Goringe, the Marquis of Granby, Mr. James Hornaby, Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. P. A. Muntz, M.P., Mr. Alfred E. Pease, M.P., Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. C. C. Rogers, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. A. J. Smith, Mr. Henry Smith, Mr. E. W. Stanforth, Mr. R. Stratton, Mr. Martin J. Sutton, Mr. J. P. Terry, Mr. R. A. Warren.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. F. S. Courtney, Consulting Engineer; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, C.B.

The following members of the York Local Committee were also present:—The Sheriff of York (Mr. Arthur Jones), Mr. Alderman Border, Mr. Alderman Foster, Mr. Alderman McKay, Mr. J. J. Hunt, Mr. W. H. Andrew, and Mr. Francis E. Walker.

Apologies for non-attendance were received from Earl Cawdor, the Earl of Coventry, Mr. J. H. Arkwright, Mr. Alfred Ashworth, Mr. B. C. Assheton, Mr. H. Chandos-Pole-Gall, Mr. A. E. W. Darby, Mr. William Frankish, Mr. S. Rowlandson, and Mr. E. V. Wheeler.

In the unavoidable absence of H.R.H. the Prince of Wales (President), the chair was, on the motion of Sir JOHN THOROLD, taken by Earl SPENCER, K.G., who, in opening the proceedings, said there was one matter to which, as they had done him the honour to ask him to fill the Chair, he thought it would be the wish of the Council he should make some allusion. As they knew, he was only in the chair in consequence of the absence of H.R.H. the Prince of Wales, their President, who was unable to be in town that day. They would all recollect that on the very day of their last meeting a cowardly and dastardly attack had been made upon His Royal Highness at Brussels. Their Society had received so many marks of favour from His Royal Highness, that he was sure the Council would wish to take the earliest opportunity which presented itself of offering their heartfelt congratulations to the Prince and Princess of Wales at their providential escape from that attack. Not only as members of the Royal Agricultural Society did they feel a great sense of relief at the Prince's fortunate escape from danger, but as Englishmen they would all wish to join in the universal sympathy which had been shown to their Royal Highnesses. (Cheers.)

**Election of New Members.**

The minutes of the last monthly meeting of the Council, held on April 4, 1900, having been taken as read and approved, the election of the

following twenty-one members was proceeded with:—

BECKETT, Wm... Manor House, Copmanthorpe, York.  
 BELL, James, jun... South Corston, Coupar Angus, Forfarshire.  
 BERTODANO, Charles E. de... Cowbridge House, Malmesbury.  
 BRISTOCKE, Wm. O... Blaenpant, Boncath, R.S.O., South Wales.  
 DURANT, William... Port Sunlight, Birkenhead.  
 OARY-ELWES, Gervase... The Manor House, Brigg, Lincolnshire.  
 HUDDART, George... Kirklington, Bedale.  
 JAMES, John... Manor House, Oughterside, Maryport, Cumberland.  
 JAMES, Joseph... Oughterside Mill, Maryport, Cumberland.  
 JOHNSON, Frederick... Mountains, Tonbridge.  
 JOHNSON, William... Cowthorpe, Wetherby.  
 LAMBERT, Thos... Bourne Hills, Hadlow, Kent.  
 MCLAREN, A. P... Warren Farm, Aynho, Banbury.  
 MORGAN, J. Ll. D... Aldwark, Easingwold.  
 PICKLES, H... Kayfield House, Earby, Colne, Yorks.  
 STUBBS, William... The Laurels, Old London Road, Hastings.  
 THOMSON, J. H... Thurlough Manor, Bedford.  
 WADE, Edward S... Brantingham Thorpe, Brongh, East Yorks.  
 WALLIS, W. Alfred... Laneswood, Mortimer, Berks.  
 WHITEHEAD, Robert... Edgemoor, Buxton, Derbyshire.  
 YEATMAN-BIGGS, W. H... Mud Hut, Eserick, York.

The reports of the various Standing Committees were then presented and adopted as below:—

#### Finance.

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the period ended April 28, 1900, as certified by the Society's Accountants, showed total receipts amounting to 2,432*l.* 19*s.* 3*d.*, and expenditure amounting to 3,505*l.* 16*s.* 11*d.* Accounts amounting in all to 2,253*l.* 4*s.* 1*d.* had been passed, and were recommended for payment.

#### House.

Sir NIGEL KINGSCOTE (Chairman) reported that various matters in connection with the Society's house had been discussed, and that the accounts for the past year of the Trustees of the Harewood House Debenture Stock had been signed by the Trustees.

After the presentation of the House Committee's Report,

Sir WALTER GILBEY said that, although not immediately arising out

of the business of the House Committee, he might perhaps be allowed to refer to a matter of interest to the Council and to the general body of members of the Society, viz., the picture of the three Royal Presidents of the Society which a number of the members and others interested in the Society's work had some time ago commissioned Mr. Orchardson, R.A., to paint for presentation to the Society. As Honorary Treasurer of the Fund which had been raised for this purpose, it had fallen to him to carry out the necessary negotiations in the matter, and he asked permission to make a short statement with reference to the picture.

It might be remembered that during the time H.R.H. the Duke of York was their President, it was felt by many of those interested in the Society that there ought to be on the premises which the Society occupied some permanent memorial of the long association of the Royal Family with the Royal Agricultural Society—an association which dated back to the very earliest formation of the Society at the commencement of Her Majesty's reign. The Queen had been graciously pleased to place herself at the head of the Society as President in the Society's Jubilee year of 1889; His Royal Highness the Prince of Wales had been thrice President, and was at this moment President for the fourth time; and the Duke of York was, as he had stated, in office when the project was set on foot by those who desired to show their loyal and grateful recognition of the conspicuous advantages which had accrued to the Society from the patronage and support of Her Majesty and the other members of the Royal Family.

They had therefore ventured to approach the three Royal Presidents of the Society with the respectful request that they would permit their portraits to be painted by an English artist of repute, with a view to such portraits being hung up in the Society's Council Chamber.

It was, of course, never contemplated that the expense of any such memorial should come out of the corporate funds of the Society; the

picture was rather intended as a present to the Society by such of the members and others associated with it as sympathised with the project. Accordingly, a voluntary subscription was set on foot, and he (Sir Walter) had the honour of being nominated as Honorary Treasurer of the Fund. In a very short time a sufficient amount was obtained to enable them to commission Mr. W. Q. Orchardson, R.A., to paint a subject-picture containing the portraits of their three Royal Presidents, who most graciously and readily assented to give sittings to the artist for the purpose.

Owing to the very numerous public duties and engagements of the Royal personages from whom sittings were essential, a longer time than was originally anticipated had been occupied in bringing this important and historic picture to completion; but he was happy now to be in a position to report that it was finished, and would be exhibited this season in the galleries of the Royal Academy at Burlington House.

By a happy inspiration, Mr. Orchardson had asked and obtained permission from his Royal sitters to add to the picture a portrait of the little Prince Edward of York; so that the painting included portraits of Her Majesty the Queen and her Heirs for three generations in the direct line of succession. As they all hoped that in due time Prince Edward of York might manifest the same keen interest in Agriculture and in their Society which had been so conspicuously displayed by his Royal ancestors, and that—at a date in the next century not so far distant but that some of the younger members of the present Council might live to see it—His Royal Highness might place himself at the head of the Society, they might prophetically describe Mr. Orchardson's magnificent picture as that of "Four Royal Presidents of the Royal Agricultural Society."

The canvas represents Her Majesty the Queen seated in a corridor of Windsor Castle. Little Prince Edward (his steps guided by his father, the Duke of York) is approaching Her Majesty carrying a bouquet of flowers, whilst the Prince of Wales looks on at the scene. The picture would

certainly be regarded as one of the most remarkable paintings of the year, and he (Sir Walter) felt it due to Mr. Orchardson to publicly express, not only his own admiration of the genius which he had displayed, but the sincere and grateful thanks of the subscribers who commissioned the picture, for the great skill and immense pains Mr. Orchardson had lavished upon it.

Their Society was to be congratulated upon receiving as a present from some of those associated with its work, a picture of such remarkable and enduring historic value. The public generally would infallibly demand that they should have an opportunity of acquiring a reproduction of a painting of such great national interest; and it might be, therefore, some considerable time yet before the picture could be deposited in its final resting-place on the walls of that Chamber. He was sure, however, that the subscribers would not grudge, and the Society would patiently wait during, the further time that it might prove necessary to keep the picture away from Hanover Square whilst it was being reproduced. He was not at this moment in a position to make any definite announcement as to copies; but those who had manifested their interest in the project, and enabled by their contributions the picture to be painted, would of course have the first claim to consideration in connection with subscriptions for the reproduction. (Applause.)

SIR NIGEL KINGSCOTE said that on behalf of the House Committee he need hardly say that they would welcome with the greatest delight as an adornment to the Society's House the valuable and historic picture to which Sir Walter Gilbert had just referred, and for the presentation of which to the Society they were almost wholly indebted to Sir Walter's energy and public spirit. It was not their practice to move formal votes of thanks to members of their own body for work which they did on behalf of the Society. But as this was a matter outside the Council, he felt that it would not be the wish of any gentleman present that the interesting announcement which had just

been made to them should be allowed to pass without some expression of their sincere and grateful thanks to Sir Walter Gilbey for this additional proof of his constant kindness and goodwill to the Society, and of their obligations to the subscribers to the Fund of which he was the honorary treasurer and moving spirit.

Sir JACOB WILSON seconded the motion, which was carried unanimously amidst loud applause.

### Journal.

Sir JOHN THOROLD (Chairman) reported that various accounts had been passed and recommended for payment and the contents of the next number of the Journal had been discussed. Various suggestions for articles and notes had been considered, and directions given to the Editor thereon.

### Chemical and Woburn.

Mr. STANYFORTH (Chairman) reported that the date of the annual visit of inspection to the Woburn Experimental Farm had been fixed for Wednesday, July 11, 1900. The Committee recommended that the report now being prepared by Dr. Voelcker upon the experiments carried out at the Pot Culture Station under the Hills Bequest should be published in an early number of the Journal.

### Botanical and Zoological.

Sir JOHN THOROLD (in the absence of Mr. Wheeler, Chairman) reported that, the reprints being now available of the second report of the Consulting Botanist and Consulting Chemist on the grass experiments conducted by the Society, the Committee recommended that copies of such reprints be sent to the various gentlemen who had kindly co-operated locally in the conduct of these experiments, with an expression of the sincere thanks of the Society for the assistance they had rendered.

The Zoologist had presented the following report:—

Several matters of interest have been brought to the attention of the Zoologist during the past month.

A case of widespread disease among fowls and pheasants was found to be due to

"scabies of the legs," caused by the mite *Sarcoptes mutans*. It is highly contagious, and diseased birds should be at once isolated, and the beams, perches, &c., they have used disinfected with dilute carbolic acid or boiling water.

The best treatment is to steep the legs for a few minutes in tepid water, and remove the scales with a brush, afterwards applying a dressing of Helmerich's pomade or balmum of Peru. After cure, the legs should be smeared with vaseline or sweet oil.

Among horticultural pests, a somewhat rare beetle, *Psylliodes hyosclami*, was reported to be doing considerable injury to henbane. Young cherry trees in Kent were found to be suffering from an attack of the larvæ of a tortrix moth, not yet identified, under the bark. Such attacks are very serious if allowed to spread, but in the early stage can be cured by scraping the injured bark and applying a paint of lime.

(Signed) O. WARBURTON.

May 1, 1900.

### Veterinary.

The Hon. CECIL T. PARKER (Chairman) reported that, as the Order of the Board of Agriculture, No. 6018, dated January 26, 1900, declaring the City of York a "Swine Fever Infected Area," was still in force, and from information received by the Committee there appeared no probability of the present restrictions being removed at an early date, the Committee, acting on the opinion of their veterinary advisers, felt that they had no alternative but to abandon with regret the contemplated exhibition of pigs in connection with the York Meeting.

Professor McFadyean had presented the following report:—

**ANTHRAX.**—During the last four weeks fifty outbreaks, with ninety-one animals attacked, have been reported. The corresponding figures for last year were forty-six and 106 respectively.

**GLANDERS.**—During the same period there have been ninety-four outbreaks of glanders, with 164 animals attacked. These figures compare unfavourably with those for the corresponding period of last year, in which the number of outbreaks was fifty-seven, and the number of animals attacked ninety-two.

**SWINE FEVER.**—During the past four weeks 163 outbreaks have been notified, as against 228 outbreaks during the corresponding four weeks of last year.

**FOOT-AND-MOUTH DISEASE.**—During the past week a fresh outbreak of this disease was discovered among cattle on the Norfolk marshes, near West Froethorpe. The owner of the affected animals had an outbreak at a farm in his possession early in February, and this was supposed to have been successfully dealt with by slaughter and subsequent cleansing and disinfection. After this first outbreak the infected premises were closed

for twenty-eight days, but since the restrictions were removed some hundreds of cattle have passed through the hands of the same owner, some of them having been kept for a time on the first infected premises. There is, therefore, great reason to fear that further outbreaks traceable to the same source will yet come to light. During the month of April numerous cases of the disease were detected among Argentine cattle landed at Deptford, but up to the present time no outbreak among British animals has been traced to this possible source of infection.

**MISCELLANEOUS.**—During the month of April forty morbid specimens were forwarded to the Research Laboratory at the Royal Veterinary College for examination. The tuberculin investigation has been continued, and ten more animals have been purchased for experiment.

### **Stock Prizes.**

**Mr. SANDAY** (Chairman) reported that letters had been received from two exhibitors of Channel Islands cattle, expressing regret that the classes for cows in the dairy breeds of cattle had this year been limited to cows six years old and under. These letters, with others received and which might be received, as to the composition of the prize sheet, had been ordered to be referred to a Sub-Committee for drafting a schedule of prizes for the Cardiff Meeting of 1901. Letters had also been received from various associations with reference to the resolution passed by the Council on February 7 last, as to the excessive colouring of sheep as now practised at shows, from which it appeared that the matter was under the consideration of the Societies representing the breeders of sheep in this country.

### **Judges Selection.**

**Mr. SANDAY** (Chairman) reported that, one of the judges of Sussex cattle being unable to act, Mr. Henry Rigden, of Ashford, Kent, had accepted the Society's invitation to fill the vacancy thus caused.

### **Implement.**

**Mr. BOWEN-JONES** (in the absence of Mr. Frankish, Chairman) reported that arrangements had been made for the provision of land at Kexby, within seven miles of York, which was very suitable for the trials of cultivators and steam diggers, and that arrangements had been made for the

trials of sheep-shearing and milking machines for the Society's prizes.

### **General York.**

The **EARL of FEVERSHAM** reported that the local arrangements for the York Meeting were in an advanced state. The Bishop of Richmond (Yorks) had kindly promised to preach the sermon to the herdsmen and others at the service to be held in the showyard on Sunday, June 17.

### **Showyard Works.**

**Sir JACOB WILSON** (Chairman) reported that the shedding for implements and machinery-in-motion had been erected, that the Members', Stewards', and Royal pavilions were complete, and the Dairy ready for tiling, and that the mains for water supply were being laid. The sales of timber after the York Meeting would take place on July 16 and 17, July 24 and 25, and August 8 and 9.

### **Selection.**

**Sir JOHN THOROLD** (Chairman) reported the recommendation of the Committee that Mr. R. M. Greaves, of Wern, Portmadoc, N. Wales, who had expressed his willingness to serve, be elected a member of Council to fill the vacancy caused by the transference of the Hon. Cecil T. Parker to the list of Vice-Presidents.

The formal election of Mr. Greaves as a member of Council was moved by **Sir JOHN THOROLD**, seconded by **Mr. BOWEN-JONES**, and carried unanimously.

### **Nomination of President for 1901.**

**Sir JOHN THOROLD** said the time had come when it was necessary to consider the question of the Presidency for the ensuing year, and he thought that the Council would agree with him that they could not have anyone more suitable for the office of President than Earl Cawdor, whose position outside the Council, as well as inside, would recommend him to them. He therefore formally moved—"That Earl Cawdor be suggested to the Anniversary General Meeting on May 22, as President for the ensuing year."

Mr. STRATTON had very much pleasure in seconding this proposal. Lord Cawdor's conspicuous services to that Society, his position as a great Welsh landowner and as Chairman of an important Railway Company, most fully entitled him to the high honour which was proposed to be conferred upon him.

The motion was then put, and carried unanimously.

Sir JOHN THOROLD said that, as it was anticipated that Lord Cawdor's duties as Colonel of the Carmarthen Militia Artillery, which was being embodied this week, would prevent his attendance at the Council meeting that day, the wish of the Committee of Selection that he would allow himself to be placed in nomination as President of the Society had been communicated to his Lordship by letter. A reply by telegram had that morning been received from Lord Cawdor, regretting his inability through his compulsory absence on military duty to express in person his sincere thanks for the compliment proposed to be paid to him, and stating that if elected by the members at the General Meeting—which he quite hoped to attend—he would do his best to carry out the duties of President of the Society. (Hear, hear.)

#### Education.

Lord MORETON (Chairman) reported that the first examination for the National Diploma in Agriculture had commenced on Monday, April 30, and was then proceeding. Various details as to the examination had been referred to a meeting of the Sub-Committee of the National Agricultural Examination Board for final settlement.

#### Dairy.

Mr. DUGDALE (Chairman) reported that fifteen entries had been received in Class 346 for kegs or other packages of butter. Col. Curtis-Hayward had reported that he had given evidence before the Departmental Committee of the Board of Agriculture on milk standards, and had informed the Departmental Committee that he could not in any way pledge the

Council in connection with the matters under discussion.

#### Special Show Committee.

The Hon. CECIL PARKER presented a further report from the Special Show Committee appointed on March 7 last "to make inquiries as to any possible sites for a permanent show-yard for the Society and to prepare estimates of expense." The report stated that a large number of letters from Corporations of towns, from other public bodies, and from individuals had been laid before the Committee, with regard to sites in various localities which were either offered or suggested as suitable for the purposes of a permanent showyard for the Society. The Committee would further consider these offers at their next meeting, with any other offers or suggestions which they might meanwhile receive. The various schemes that were being proposed in different parts of the country must obviously take some time to mature, and it would not therefore be possible for the Committee to present any definite recommendations for some considerable period to come. The results of the Committee's further consideration of the question tended, however, to confirm the view expressed in their report of April 2, that the most desirable plan would be for the Society to be placed in the position of renters for a portion of the year of any site which might be selected, rather than it should have any responsibilities for the purchase of land or its upkeep and management during the whole of the year.

Mr. PELL said that, without desiring in the least to question what had been already decided with regard to a permanent showyard—he himself being one of the thirty-eight who had voted for it—he thought it would be a considerable advantage, now that the general question had been settled, that any further reports by the Special Committee, consequent upon the acceptance of the first report, should be considered in Committee by the whole Council, so that the Special Committee might have the advantage, which they appeared to desire, of hearing the views of the other

members of the Council expressed less formally than at the Council meetings. He thought that in this way the Special Committee would acquire a good deal of valuable information and assistance which might not otherwise come before their notice. No doubt due intimation would appear on the Agenda paper that on a given date the Special Committee would present recommendations to the Council, and members of the Council would then have the fullest opportunity (if they chose to avail themselves of it) of laying before the Council when sitting in Committee any representations which they desired to bring forward for consideration.

After some discussion as to procedure, Mr. PELL said that, to put himself in order, he would give formal notice of his intention to move a resolution in the sense of his suggestion.

The Hon. CECIL PARKER said that, as the Special Committee had more than once stated, they were willing and anxious to receive and consider suggestions from any member of the Council, and, indeed, from any quarter, as to the subject of the reference made to them by the Council on March 7. Their original report, presented at the Council Meeting on February 7, had been put into public circulation immediately thereafter, and had been much discussed in the newspapers, before the Council met on March 7 at a special meeting to consider it. The Committee's subsequent reports, presented on April 4 and on that day, had been more or less formal in character, and had contained no fresh recommendations to the Council. Of course, full and adequate notice would be given of any intention by the Committee to present the "definite recommendations" referred to in the report which he had just read. If it should be the feeling of the Council that such recommendations or any future report of the Special Committee could more conveniently be discussed

by them in Committee, he, for one, saw no objection, as it was the desire of the Special Committee that the matter should receive the amplest consideration before anything definite was decided upon as to the future location of a permanent showyard for the Society.

#### **Retiring Members of Council.**

The SECRETARY formally laid upon the table the list of the 24 members of Council retiring by rotation but eligible for re-election at the General Meeting (see page lxxviii), and announced that no further nomination beyond that of Mr. R. W. Eddison, of Leeds, had been received for the vacancy on the Council caused by the death of Mr. Dan Pidgeon.

#### **Meeting of 1902.**

On the motion of Sir JOHN THOROLD, seconded by the Hon. CECIL PARKER, it was resolved that, in accordance with the existing scheme of rotation, the Society's meeting of 1902 be held at some town in District G (consisting of Cheshire, Lancashire, and North Wales), provided that some suitable and adequate site were offered for the purpose.

#### **Queen Victoria Gifts Fund.**

Sir WALTER GILBEY, in presenting a report from the Trustees of the Queen Victoria Gifts Fund, said that the Trustees proposed to grant to the Royal Agricultural Benevolent Institution for 1900 as in 1898 and 1899, the sum of 250*l.*, to be distributed in the same proportions as before.

#### **Miscellaneous.**

The Report of the Council to the Anniversary General Meeting, to be held on May 22, at 13 Hanover Square, W., having been prepared (see page 347) and other business transacted, the Council adjourned until Wednesday, May 30, at 10.30 A.M.

## WEDNESDAY, MAY 30, 1900.

H.R.H. THE PRINCE OF WALES, K.G. (PRESIDENT), IN THE CHAIR.

**Present.**

*Trustees.*—General Viscount Bridport, G.C.B., Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., Earl Spencer, K.G., Sir John H. Thorold, Bart.

*Vice-Presidents.*—H.R.H. Prince Christian, K.G., the Earl of Feverham, the Rt. Hon. Sir Massey Lopes, Bart., Lord Moreton, the Hon. Cecil T. Parker, Sir Jacob Wilson.

*Other Members of Council.*—Mr. Alfred Ashworth, Mr. R. O. Assheton, Mr. J. Bowen-Jones, Lord Brougham and Vaux, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Colonel Curtis-Hayward, Mr. A. E. W. Darby, Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. W. Frankish, Mr. Hugh Gorringe, the Marquis of Granby, Mr. R. M. Greaves, Mr. James Hornsby, the Earl of Jersey, G.C.B., Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. P. A. Muntz, M.P., Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Henry Smith, Mr. J. P. Terry, Mr. R. A. Warren, Mr. E. V. V. Wheeler.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor McFadyean.

The following members of the York Local Committee were also present:—Mr. Alderman Border, Mr. Alderman Foster, Mr. J. J. Hunt, Mr. W. H. Andrew (Town Clerk), and Mr. Francis E. Walker.

Apologies for non-attendance were received from Earl Cawdor, the Earl of Coventry, Mr. J. H. Arkwright, Mr. H. Chandos-Pole-Gell, Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. A. J. Smith,

Mr E. W. Stanyforth, Mr. Martin J. Sutton, Mr. O. W. Wilson; and Mr. W. Carruthers (Consulting Botanist).

**Election of Governors and Members.**

The minutes of the last Monthly Meeting of the Council, held on May 2, 1900, having been taken as read and approved, the election of the following two Governors and thirty-one Members was proceeded with:—

*Governors.*

WESTMINSTER, The Duke of .. Eaton Hall, Chester.  
BATES, Cadwallader J... Langley Castle Northumberland.

*Members.*

ARMITAGE, Robert...Farnley Lodge, near Leeds.  
BLACKBURN, F. W...Tankardstown, Slane, co. Meath.  
BROCKLEBANK, Harold...4 Fulwood Park, Aigburth, Liverpool.  
BROUGHAM, Major James...Court House, Beningborough, York.  
BROWNE, Mrs. A. H...Callaly Castle, Whittingham R.S.O., Northumberland.  
CANTERBURY AGRICULTURAL AND PASTORAL ASSOCIATION...Christchurch, New Zealand.  
CLARKE, F. W...Hannan's Hall Farm, Tendring, near Colchester.  
COY, John...Stoneycroft, Leicester.  
CRESSWELL, G. G. Baker...87 South Lambeth Road, London, S.W.  
CROSS, Adam F...Craigiehall, Cramond Bridge, Midlothian.  
DARGUE, John...Burnside Hall, Kendal.  
DASHWOOD, Alfred H...Stibbington House, Wansford.  
DAWSON, Guy R. F...Launde Abbey, Leicester-shire.  
GEMMELL, Alexander...Chelston, Ayr, N.B.  
GIBSON, George...High Callerton, Ponteland, Northumberland.  
HARVEY, Augustus...Wattisham Hall, Bideston, Ipswich.  
HALLITT, A. Miller...Godington, Chelmsfield, Kent.  
HOWARD, F. J. C...Collinstown, Letchlip, co. Kildare.  
KING, George...Wymondham House, Oakham.  
KOSTER, Theodore A...Bell Yard, City Road E.C.  
LANGMEAD, W. J...Clymping, Littlehampton, Sussex.  
MACKENZIE, Sir Kenneth J., Bart...Gairloch, Ross-shire.  
PHILIPS, Arthur D...Heybridge, Tean, Stoke-on-Trent.  
REID, Charles...The Studio, Wiahaw, Lanark-shire.  
RODERICK, W. Buckley...Fronheulog, Llanelli.  
SANDRICK, Gilbert R...Stoneleigh, Rossett, Wrexham.

SCRINGBOUR, James, Jun...Starr Cliff, Great Lever, near Bolton.

SMITH, W. Stanley...Highfield, near Wrexham.

TANNER, Ernest D...Keythorpe Grange, East Norton, Leicester.

TAYLOR, Samuel...Birkdault, Haverthwaite, *via* Ulverston.

WRIGHT, Rupert S...8 Lambton Row, Newcastle-on-Tyne.

On the motion of Sir NIGEL KINGSCOTE, seconded by Sir JOHN THOROLD, it was unanimously resolved "that the next election of candidates for membership of the Society take place at the Council Meeting to be held in London on August 1, but that the Secretary be empowered meanwhile to issue to any duly nominated candidate on receipt of a remittance for 1*l*. (the amount of the annual subscription of a member) a special ticket admitting the candidate to the same privileges as a member during the York meeting; the question of the formal election as member of such candidate to be considered by the Council on August 1."

Sir JOHN THOROLD, as Chairman of the Committee of Selection, formally introduced Mr. R. M. Greaves, who attended for the first time as a newly-elected member of Council.

The reports of the various Standing Committees were then presented, and adopted as below:—

#### Finance.

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the period ended May 26, 1900, as certified by the Society's Accountants, showed receipts during that period amounting to 900*l*. 13*s*. 10*d*., and expenditure amounting to 2,253*l*. 7*s*. 8*d*. Accounts amounting in all to 7,415*l*. 15*s*. 5*d*. had been passed and were recommended for payment.

#### Journal.

Sir JOHN THOROLD (Chairman) reported that Sir Henry Roscoe had kindly consented to write a biography of Sir Humphry Davy for the March number of the Journal next year. Various suggestions for articles and notes had been considered, and directions given to the Editor thereon. The contents for the forthcoming number of the Journal had been settled. A letter had been read from

the Secretary of the Meteorological Office intimating the willingness of the Meteorological Council to send out forecasts during the Hay Harvest to applicants without any charge beyond the cost of the telegrams, and requesting that facilities for obtaining such forecasts should be made known as widely as possible. The Committee recommended that a notification to this effect should appear in the Proceedings of the Council.

#### Chemical and Woburn.

Mr. R. A. WARREN, in the absence of Mr. E. W. STANYFORTH (Chairman), reported the conclusion of the bullock-feeding experiments, and that Dr. Voelcker had presented a statement as to the progress of the field experiments at Woburn. Various points arising out of the Consulting Chemist's correspondence had been considered, and instructions given thereon.

#### Botanical and Zoological.

Mr. E. V. V. WHEELER (Chairman) reported that order forms and conditions of purchase for seeds for the use of members, in the same way as those issued for fertilisers and feeding stuffs, would shortly be available. The Committee had requested Mr. Carruthers to give evidence on behalf of the Society before the Departmental Committee of the Board of Agriculture appointed to inquire into the conditions under which agricultural seeds are at present sold. Having considered the suggestion made by Mr. W. Lipscomb at the General Meeting held on May 22 last, "that the Society's experiments on the extermination of weed pests of the farm should be continued," they had decided upon the following reply:—

Further inquiry is being conducted at Woburn into the nature of the soil on which certain prevalent weeds flourish and on the means of their eradication.

Wild Marigold, Wild Onions, Wild Oats, and Wild Poppy are again under investigation, and also Spurry and Sorrel. Soils on which these several weeds grow are being submitted to chemical analysis in order to see if there be any constituents which determine or influence their presence.

The application of lime on a practical scale in the field for destroying Wild Marigold, and the treatment of Wild Onions by carbolic

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acid, also in the field, are being carried out in the neighbourhood of Woburn.

Similar and further trials on weed destruction are proceeding at the Woburn Pot Culture Station.

The Zoologist had presented the following report:—

The applications received by the Zoologist during the past month have been of a miscellaneous character, and have not included the usual number of fruit-tree pests, which appear this year to be giving less than the ordinary amount of trouble.

Complaints have been received of the pea and bean weevil, *Sitona*, the insect which notches the edges of the leaves in a characteristic manner. It is best treated by the application of soot when the crop is wet with heavy dew. It is rather remarkable that the grub of this insect has only been noticed as the cause of injury to bean and pea roots during the past two or three years, though the weevil has been a familiar pest for many years. In fact, there was formerly considerable doubt as to how the insect spent its larval life, but during the last three years it has been a frequent subject of complaint by farmers.

Inquiries have been received with regard to the warble fly, and a bad attack of sheep bot fly has been reported, resulting in the death of many of the animals. It is unfortunate that this pest is scarcely ever recognised till it has almost run its course and treatment is superfluous. The fly lays its eggs on the nostrils of sheep when ruminating during the hot days of summer, and the resulting grubs enter the nasal passages, and sometimes gain access to the brain, causing paralysis and death. They remain in the sheep's head until the following May, causing at the least great uneasiness and loss of condition; but the symptoms are most pronounced just when they have become fully grown and are finding their way out, and it is then that the disease is generally first recognised.

Precautions may be taken to prevent the fly attacking the sheep. Pastures bordered by brushwood should be avoided in the hot weather, if the fly is known to be about—and the sheep indicate this by uneasily shaking their heads and rubbing their noses on the ground.

Among other pests complained of are green-fly, crane-fly, and wheat bulb-fly. One inquiry had reference to the appearance of swarms of minute black insects on the puddles of water in a fold-yard. These were *Podar aquatica*, perfectly harmless in themselves, but indicating that the water was foul and unfit for the animals to drink.

(Signed) C. WARBURTON.

May 29, 1900.

#### Veterinary.

The Hon. CECIL T. PARKER (Chairman) presented the following report as to the prevalence of cattle diseases, &c., which had been received from Professor McFadyean:—

ANTHRAX.—During the last three weeks for which official returns have been issued, the outbreaks numbered 38, with 50 animals attacked. The corresponding figures for last year were 44 and 87 respectively.

GLANDERS.—During the same period there were 68 outbreaks, with 112 animals attacked. These figures denote a rather serious increase in the prevalence of the disease, as during the same period of last year there were only 33 outbreaks, with 34 animals attacked.

SWINE FEVER.—During the same three weeks 177 outbreaks have been notified, as against 242 outbreaks in the corresponding period of last year.

FOOT-AND-MOUTH DISEASE.—During the week ended May 19 a fresh outbreak was detected, viz., in Hertfordshire. It involved only 3 cattle, and these have been slaughtered. No other case of the disease has been detected since the end of April.

MISCELLANEOUS.—Since May 1 forty-six morbid specimens had been received for examination at the Research Laboratory at the Royal Veterinary College. These represented the usual variety of diseases. Reports and specimens which have reached the Laboratory show that in some parts of the country very serious losses among sheep have been caused during the current month by the larvae of the *Exorista oris*. This fly deposits its eggs upon the nostrils of sheep about the month of July, and the larvae develop in the air-sinuses of the head and roots of the horn-core in horned sheep, where they generally remained attached till the following May.

#### Stock Prizes.

Mr. G. H. SANDAY (Chairman) reported that the number of entries of live stock which had been received for the York Meeting was 1,997—viz. 696 horses, 687 cattle, and 614 sheep, besides 629 entries of poultry and 528 of produce.

#### Judges Selection.

Mr. G. H. SANDAY (Chairman) reported the appointment of Mr. John B. Cookson, of Askham Bryan, York, as a judge of heavy-weight hunters, in the place of Mr. William Wright, of Wollaton, deceased; and of Mr. Herbert Padwick, of the Manor House, West Thorney, Emsworth, as a judge of Jersey cattle. The Committee recommended that the judges appointed for the Shire horses should also be asked to judge the draught horses entered in Classes 80 to 85, on Thursday, June 21.

#### Implement.

Mr. W. FRANKISH (Chairman) reported that the final arrangements for the several trials of implements to be held in connection with the York Meeting had been completed, and

that the trials would commence on the following dates :—

Class I.—Horse-power Cultivators : Tuesday, June 12, at 9 A.M., on land at Kexby, six miles from York.

Class II.—Self-moving Steam Diggers : Wednesday, June 13, at 9 A.M., on the same farm at Kexby as Class I.

Class III.—Milking Machines : On Friday, June 15, at 9 A.M., in the Showyard.

Classes IV. and V.—Sheep-shearing Machines : Tuesday, June 19, at 9 A.M., in the Showyard.

Mr. J. Broughton Dugdale, of Wroxall Abbey, Warwick, being unable to act as a judge of miscellaneous implements and milking machines at the York Meeting, the Committee had recommended the appointment of Mr. Bayntun Hippisley, of Ston Easton Park, Bath, to act in his stead. The Committee had considered a suggestion that prizes should be offered by the Society for wind engines, and had recommended that trials of these machines should be held in 1901.

#### General York.

The Earl of FEVERSHAM reported that the programme for the York Meeting had been finally discussed, and with certain modifications approved. The usual applications had been received from breed and other societies for permission to hold meetings in the Showyard, and the following time-table for such meetings had been settled :—

#### Monday, June 18.

English Aberdeen-Angus Cattle Association . . . 2 P.M.  
Shropshire Sheep-Breeders' Association . . . 3 P.M.

#### Tuesday, June 19.

Hackney Horse Society . 11.15 A.M.  
Royal Agricultural Society of England . . 12.30 P.M.  
Shire Horse Society . . 2 P.M.  
Shorthorn Society . . 2.30 P.M.  
Polo Pony Society . . 3 P.M.  
National Pig Breeders' Association . . . 4 P.M.

#### Wednesday, June 20.

Hunters' Improvement Society . . . 2 P.M.  
National Traction Engine Owners' Association . 4 P.M.  
Agricultural Implement Dealers' Association . 5 P.M.

#### Showyard Works.

Sir JACOB WILSON (Chairman) reported that the erection of the Implement Yard, Pavilions, and Dairy had been completed, and that the shedding in the Stockyard was in a forward state. Arrangements had been made for the provision of coal and coke to the exhibitors in the Showyard, the price of Welsh steam coal to be 2s. 6d. per cwt., and of coke 1s. 6d., per cwt., delivered at the stand. The Committee had considered the possibility of some exhibition of the work of the prize-winners in the horse-shoeing competitions in the York Showyard, and they recommended that the regulations for the Cardiff meeting of 1901 be amended, with a view to this object being carried out.

#### Selection.

Sir JOHN THOROLD (Chairman) reported with great regret the sudden death on the night of May 21 of Mr. R. W. Eddison, of Leeds, who had been duly nominated as a member of the Council, to fill the vacancy caused by the death of Mr. Dan Pidgeon. Mr. Eddison's death not having been notified to the Society before the General Meeting held on May 22, it became necessary for the Council to take steps for the election of another member of the Society to fill Mr. Pidgeon's vacancy, and the Committee presented a recommendation on this point which they would formally submit for approval at the next meeting of the Council.

The Committee had considered the suggestion made by Mr. G. D. Yeoman as to the dates on which the December meetings of the Council and of the members should be held. The Council had already considered this matter on several previous occasions, and had adopted on February 6, 1900, the following minute of the Journal Committee :—

The Report to the December Meeting is only prepared by the Council on the day preceding the General Meeting, when also the final settlement is made of the prizes for the Country Meeting of the next year, in accordance with the standing orders of the Society. The various announcements as to these prizes constitute a large portion of the Report, and if the General Meeting were held at a date after the Smithfield week, the

members who are chiefly interested in this report would in all probability be absent.

Mr. Yeoman had suggested that the Council should sit in the week before the Smithfield week, but this would involve long journeys in two successive weeks by members of the Council who undertake the work of the Society, and who are also interested in the Smithfield Club. As an alternative Mr. Yeoman had suggested that the meeting of the Council should be held on Friday (instead of the Thursday) of the Smithfield week, but this would necessitate members of the Society making a longer stay in town for the purpose of attending the meeting. On the whole, therefore, the Committee were unable to see their way to recommend a change in the existing system.

#### *Election of an Honorary Member.*

Sir JOHN THOROLD said he understood that Landrath von Etzdorf, Director-General of the East Prussian Estates of His Imperial Majesty the German Emperor, was now in this country making some agricultural inquiries, and that it was possible he might be able to attend the Society's forthcoming meeting at York. Under these circumstances, it seemed desirable that the Council of the Royal Agricultural Society should show its appreciation in some special manner of the visit of the representative of the German Emperor to this country, and he therefore proposed, with the concurrence of the Committee of Selection, that Landrath von Etzdorf be elected one of the twenty-five Honorary Members of the Society.

H.R.H. Prince CHRISTIAN, in seconding the proposal, said that Herr von Etzdorf had been his guest in this country, and he (Prince Christian) had had the pleasure of showing him over the Royal and other farms. Herr von Etzdorf took a great interest in Agriculture, and the German Emperor would, he felt sure, appreciate the compliment paid to his Landrath.

H.R.H. the PRESIDENT, in putting the motion, thoroughly endorsed the remarks which had fallen from Sir John Thorold and Prince Christian,

and quite approved of what was proposed. Herr von Etzdorf was thereupon unanimously elected an Honorary Member of the Society.

[After the Meeting of the Council, the following telegram was addressed by H.R.H. the President to H.I.M. the German Emperor:—

"I have great pleasure in informing you that at a meeting to-day of the Royal Agricultural Society, of which I am the President, Landrath von Etzdorf was unanimously elected one of the twenty-five Honorary Members of this Society.

"ALBERT EDWARD."

On receipt of this telegram, His Imperial Majesty sent the following reply to H.R.H. the Prince of Wales:—

"Please accept my sincere thanks for your kind telegram, and convey my highest appreciation of the great honour conferred on Landrath von Etzdorf by his unanimous election to the members of the Royal Agricultural Society.

"WILLIAM I.R., Potsdam."

#### *Education.*

LORD MORETON (Chairman) reported that the Committee recommended that the report of the National Agricultural Examination Board on the results of the first examination for the National Diploma in Agriculture, which had been held at Leeds from April 30 to May 4 last, should, following upon the series of reports on the results of the Society's own examinations, be printed in the Journal and circulated among the candidates and others (see page 357). The Committee had considered the suggestion made by Mr. G. D. Yeoman at the Anniversary General Meeting as to the employment of children of school age on farms in the summer, their education being continued during the winter months, and they recommend that members of Council should be asked to ascertain the feeling on this point amongst agriculturists in their respective districts. In view of the resolution adopted by the Council of this Society on February 1, 1893, at the instance of the Education Committee, "That it was desirable that provision should be made in all Universities for the granting of a degree to students of agriculture," the Committee had noted with pleasure that the Senate

of the University of Cambridge had passed on Friday last (May 25) a grace for the establishment of a special examination in Agricultural Science for the ordinary B.A. degree.

Mr. PELL was gratified to observe the progress which the question of agricultural education was making at the Universities, but at the same time he thought it right to point out the great step taken by the University of Cambridge was largely owing to the initiative of Sir Walter Gilbey, without whose action in the matter he (Mr. Pell) did not believe they would have found themselves in the favourable position they occupied at the present time. (Hear, hear.)

#### **Dairy.**

Mr. DUGDALE (Chairman) reported that 168 entries of butter, 84 entries of cheese, and 107 entries of cider and perry had been received for the York Meeting. The Committee had before them two suggestions made by Mr. G. D. Yeoman at the Anniversary General Meeting (a) as to the preservation of milk in pure condition whilst in transit and at railway stations, and (b) as to the means of preserving eggs in good condition for a length of time. The Committee considered that the former was a matter with which they were unable to deal, and did not recommend that any action be taken in the latter.

#### **Special Show Committee.**

Mr. ALBERT PELL, pursuant to notice, moved the following resolution standing in his name:—"That with a view to the fuller discussion of any further reports which may be presented by the Special Committee reappointed on March 7 last 'to make inquiries as to any possible sites for a permanent showyard, and to prepare estimates of expense,' it is desirable that all such reports should be considered by the Council when sitting in Committee of the whole Council."

The Earl of FEVERSHAM, in second-

ing the motion, said he thought it very important that, in view of the great change contemplated by the Special Show Committee of abandoning the system of migratory shows, and establishing a permanent showyard at a fixed centre, the Council should be kept fully informed of all the proposals of the Committee, and should have the opportunity of expressing their opinion upon such proposals. His Lordship did not make these observations in any spirit of hostility, though at first he had rather been opposed to the scheme, but it was clearly right that the proposed change should only be sanctioned by the Council after the fullest deliberation. For these reasons he cordially supported Mr. Pell's motion.

The Hon. CECIL T. PARKER, as Chairman of the Special Show Committee, asked to be allowed to explain that there had never been any intention on the part of the Committee to act without taking the fullest opportunities of consulting the Council. They desired rather that whatever was done should be first subjected to every possible investigation and discussion. Neither the Special Show Committee nor himself offered any objection to Mr. Pell's resolution, if it should be considered desirable to pass it.

The motion was then put by the PRESIDENT, and carried unanimously.

#### **Suggestions made at General Meeting.**

The replies to the suggestions made by members at the Anniversary General Meeting on May 22, 1900, were settled in accordance with the recommendations of the Botanical, Selection, Education, and Dairy Committees.

A suggestion made by Lord BARNARD, relating to the future action of the Society with regard to shows, was referred to the Special Show Committee for consideration.

The Council then adjourned until Wednesday, June 20, 1900, at 1 P.M., in the Showyard at York.

## Proceedings at the Sixty-First Anniversary Meeting of Governors and Members,

HELD AT THE SOCIETY'S HOUSE, 13 HANOVER SQUARE, LONDON, W.

TUESDAY, MAY 22, 1900.

SIR JOHN THOROLD, BART. (TRUSTEE), IN THE CHAIR.

THE Sixty-first Anniversary General Meeting of the Governors and Members of the Royal Agricultural Society of England was held at the Society's House, 13 Hanover Square, W., on Tuesday, May 22, 1900, Sir John Thorold, Bart. (Trustee), in the Chair. There were present:—

*Trustees.*—Earl Cawdor, Colonel Sir Nigel Kingscote, K.C.B.

*Vice-Presidents.*—The Right Hon. Sir Massey Lopes, Bart., Lord Moreton, the Hon. Cecil T. Parker, Mr. Charles Whitehead, Sir Jacob Wilson.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. R. C. Assheton, Viscount Baring, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. Percy Crutchley, the Earl of Derby, K.G., Mr. J. Marshall Dugdale, Mr. W. Frankish, Mr. James Hornsby, the Earl of Jersey, G.C.B., Mr. Albert Pell, Mr. J. E. Ransome, Mr. C. C. Rogers, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. J. P. Terry, Mr. C. W. Wilson.

*Governors.*—Lord Barnard, Mr. Charles E. Ashworth, Mr. Thomas G. Benn, Mr. W. H. O. Duncombe, Colonel T. A. Irwin.

*Members.*—Viscount Powerscourt, Lord Balcarras, M.P., Professor Sir George Brown, C.B., Messrs. Arthur W. Arkwright, Edmund Ashworth, George Barbour, W. Roland Burke, Charles Burrell, jun., J. P. Cockerell, Richard Cooke, C. Cope, James P. Coultas, S. H. Cowper-Coles, A. Crosskill, H. S. Daine, A. H. Dellschaft, T. F. Egerton, George H. Evans, J. Douglas Fletcher, E. Foden, W. W. Glenny, Ernest H. Godfrey, H. J. Greenwood, James T. Hobbs,

W. A. Hounsom, John Howard Howard, Surgeon-Lieut.-Colonel J. Ince, M.D., Messrs. G. P. Mitchell Innes, Henry Jonas, Wm. Lipscomb, J. R. Markby, W. Rainforth, jun., F. S. Schwann, L. H. Becher Shand, Thomas Stirton, G. F. Strawson, Harold Swithinbank, J. Herbert Taylor, R. Palmer Tebb, Edward Trimmen, John E. Welby, T. P. Wilkes, G. D. Yeoman.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. F. S. Courtney, C.E., Consulting Engineer; Mr. J. E. Compton - Bracebridge, Assistant Director.

Apologies for non-attendance were received from the Earl of Coventry, Earl Spencer, K.G., Lord Brougham and Vaux, the Right Hon. Walter Long, M.P., Sir Walter Gilbey, Bart., Mr. Alfred Ashworth, Mr. R. M. Greaves, Mr. H. D. Marshall, Mr. R. Jasper More, M.P., Mr. F. Reynard, Mr. E. W. Stanyforth, and Mr. Martin J. Sutton.

On the motion of Sir NIGEL KINGSCOTE, seconded by Surgeon-Lieut.-Colonel INCE, Sir John Thorold was called to the Chair, in the unavoidable absence of the President, H.R.H. the Prince of Wales. Sir Nigel Kingscote announced the receipt of a letter from Sir Francis Knollys, stating that the Prince of Wales was unable to preside at the meeting owing to his presence at the inspection of a new battalion of Scots Guards, and later at a luncheon at the Mansion House with the Elder Brethren of the Trinity House.

The SECRETARY having read the bye-laws governing the transaction of

business at the Anniversary General Meeting,

#### **Election of President for 1900-1901.**

Mr. CHARLES E. ASHWORTH said he had much pleasure in proposing the resolution, "That Earl Cawdor be elected President of the Society for the year following the York Meeting."

Mr. W. LIPSCOMB, in seconding the resolution, remarked that he had no doubt from the very long connection which his Lordship had had with the Council, that he would be equal to those who had preceded him in the Chair, and that he would do everything they could desire of him in the capacity of President.

The resolution having been put and carried unanimously,

Earl Cawdor tendered his grateful thanks to the meeting for the very kind way in which they had nominated and elected him as their President for the coming year. He could only say that it would be his endeavour to follow in the footsteps of those who had gone before him, and especially of their very distinguished President of this year, His Royal Highness the Prince of Wales. He (Lord Cawdor) would make every effort in his power to successfully carry out the duties of the high office to which he had just been elected. (Cheers.)

#### **Report of Council.**

The twelve Trustees, twelve Vice-Presidents of the Society, and twenty-four members of Council having been re-elected,

The SECRETARY read the salient parts of the Report of the Council to the General Meeting.

Viscount POWERSCOURT, in moving the adoption of the Report, said he could only suppose that he had been asked to do so because he had the honour to preside over an analogous body in Ireland, viz., the Royal Dublin Society, of which he had been President for the past six years. They had to deplore the death of the Duke of Westminster, whose services, not only upon that Council and to Agriculture, but also to many other useful institutions in the country, had been so conspicuous. There was one other

loss to which he might refer, and that was the death of the Marquis of Winchester, who died serving in South Africa. He was glad to see that the Meeting of this year was to be held at York, where there was ample space for the show.

A Committee was sitting that had taken steps to decide upon the question of the Society's shows being held in future upon a permanent location near some large town, and thereby endeavour in future to bring the people to the show, and not the show to the people. In the case of the Royal Dublin Society, they had adopted the same system a good many years ago. They had found that such towns as Ballinasloe, Cork, Galway, and other towns in the provinces of Ireland were not rich enough to bear the expense of a large show, and he and others worked very hard to persuade the Dublin people that it would be wiser if the shows were held permanently in Dublin, and the people in the provinces induced to come up to Dublin to the show. They had bought the land from Lord Pembroke, and had erected permanent buildings which covered more than five acres, and which he thought were unequalled in the kingdom. Anyone who visited their Dublin Horse Show would admit that they might say without any vanity that their horse shows were amongst the most remarkable sights in the United Kingdom. They were, in fact, an unparalleled success. This was chiefly due to the fact of the position being central, so that not only visitors from Ireland and from other parts of the United Kingdom attended the show, but numerous visitors, including Frenchmen, Germans, and other foreigners, were also attracted. If the Royal Agricultural Society located themselves permanently, as they proposed to do, he could not help feeling that it would be a very wise move.

In Clause 23 of the Report he noticed that the Society had been devoting itself to the question of the cultivation of grass land. Upon this subject he could speak from experience, for Ireland was essentially a grass land country, and he was glad to find that both societies were work-

ing in the same direction. In the present depressed state of agriculture the cultivation and preservation of grass land was of very great importance.

In the paragraph relating to the Zoologist's Department, he was glad to find that much useful work was being done in the eradication of perennial pests and of parasitic diseases. With reference to the recent outbreak of foot-and-mouth disease, he was afraid he should have to refer to Ireland again. They had had to shut out English cattle altogether from that country, and the Privy Council had, in fact, adopted the most stringent regulations against the importation of any cattle into Ireland. The only exception to this rule was at the recent Dublin Show, when they were honoured by the exhibition of one of Her Majesty's bulls, which carried off the first prize. He (Lord Powerscourt) had the satisfaction of watching the judging, and at last the award lay between two bulls, the one belonging to an Irish gentleman, and the other to the Queen. Everybody admitted that Her Majesty's bull was *primus inter pares*. He had much pleasure in moving the adoption of the Report.

Mr. W. W. GLENNY, in seconding the adoption of the Report, said that he did so with feelings both of pleasure and of regret—pleasure that the Society's operations had been carried out so very successfully for the past twelve months, and regret that the last summer gathering had resulted in such a serious loss to the Society's finances. He did not think they had ever held a meeting on a more delightful showground, nor had more trouble ever been taken to make the show a success. The financial deficit, however, had led the Council to consider the question as to whether these perambulatory shows should not be discontinued. As the matter was in the hands of such a powerful Committee, perhaps their best plan was not to enter into details that day, but to leave it to the Council, who were giving their very best attention to the subject, and would, he felt confident, arrive at a right conclusion. Of course, some of them who had been in the habit of going to a different district each

year would be very sorry to go always to one place.

He regretted the outbreak of foot-and-mouth disease, referred to in the Report. This malady was one of the most troublesome they had to deal with, especially with regard to milch cows, causing serious injury and loss to farmers. He would note particularly that the disease had been brought over from Argentina, and that the Board of Agriculture had taken steps to prevent the disease being brought over again. He would, however, suggest to the authorities that when they sent the carcasses out to the North Sea, they should take a skilled navigator with them who understood the set of the tides, so that those carcasses might not be brought to the shores of Essex. At present they were being washed up by hundreds upon the islands of Foulness, Wallesca, and Havengore. He had much pleasure in seconding the adoption of the Report.

The CHAIRMAN then put the motion for the adoption of the Report, which was carried unanimously.

#### Suggestions of Members.

In response to the usual inquiry from the Chair, as to whether any Governor or Member had any remark to make or suggestion to offer that might be referred to the Council for consideration,

Mr. G. D. YEOMAN said that at the General Meeting of members held in December last he had brought forward several questions which had been referred to the various Committees concerned for consideration. These he ventured again to press upon the attention of the Council. His first inquiry was whether it was possible that an interval could elapse between the December Meeting of the Council and the General Meeting held on the following day, as when the report to the General Meeting was put into their hands a few minutes only before the meeting took place, members had no time to give it adequate consideration. He had understood that it was not possible to carry out the suggestion which he then made, but he should like to ask the Council

whether it was possible either that the General Meeting in December could be arranged to be held on Friday instead of Thursday of the Smithfield Show week, so that a day might elapse between the two meetings, or that the Council Meeting could be held in the previous week.

He would also be glad if the Council could see their way to give further consideration to the question of the use of preservatives for the maintenance in a pure and sweet condition of milk sent up to London from the country. Although milk could be cooled to 58 deg. by means of refrigerators, in his opinion means might be adopted to bring it to London more sweet and pure, especially in thundery and hot weather. Several preservatives had been suggested, and he believed that a Departmental Committee was still sitting to discuss and investigate the matter. Perhaps the Council were awaiting the result of the Departmental Committee's Report.

The accommodation provided by railway companies for the conveyance of milk to London was totally insufficient. He had himself seen only that morning cans of milk in passenger vans piled with leather portmanteaux and other luggage, and this state of affairs was especially noticeable on the southern lines. He trusted the Council might see their way to take some steps to draw the attention of the railway companies to this matter, with a view to their providing proper milk vans for the carriage of milk.

He would, moreover, ask the Council to urge the authorities of the Education Department to allow boys of a certain age (say, eleven, twelve, or thirteen) to work upon the farm in summer, and to return to school in winter. By this means the boys would learn to do a great deal of farm work in that time, and at the expiration of their school terms they would be able to earn better wages than they could command at present.

With reference to the question as to whether the Society's shows should in future be migratory or held in one place, he personally was quite in favour of a permanent location; but he should like to point out that,

whatever centre was eventually fixed upon, the land occupied by the Society would be considerably enhanced in value. He therefore suggested to the Council that by purchasing the land they might be making a valuable investment; or if they did not see their way to do this, they should insist upon such terms in their lease as would prevent the raising of the rent at the expiration of two or three years. The most desirable towns were, in his opinion, those possessing racecourses, and of these he enumerated several. He wished to bring before the notice of the Council a method which had lately been brought out for the preservation of eggs, by which process they could be kept in good condition for a considerable time. This information might possibly be of value, for eggs could be put down when they were very cheap and kept for a better market.

Mr. W. LIPSCOMB said he was glad to see that the Society, in addition to carrying out grass experiments, had taken up the question of the eradication of weeds, and that the experiments in the eradication of charlock by spraying had been a distinct success. These experiments were of great agricultural interest, and he hoped the Society would continue to inform farmers as to the best means of eradicating noxious weeds.

Mr. ARTHUR ARKWRIGHT suggested that a flagstaff should be provided for the Society's house.

Mr. CROSSKILL said he wished to refer to the great question as to what should be the future of the Society, and whether its mode of operations was to be entirely altered. Was the Country Meeting to be fixed in one centre instead of going from place to place? The change proposed was a most important one, and it had been very little touched upon at that meeting. The members were not so unanimous upon the subject as perhaps might have been thought from the few words that had been said about it. He believed that the members of the Committee who were considering the question were very able men, who did their best for the Society; but he ventured to predict with confidence that whatever they decided would create a great deal of

dissatisfaction. (Laughter.) Having attended, with one or two exceptions, every Country Meeting since 1844, he said, without hesitation, that the proposed change was a most perilous experiment, and one which could only be made with the very greatest trepidation, whether successful or not. Amongst the important points which the Committee would have to decide was the question as to where the show should be held. He thought it was understood that the show was to be held at one place in future; but was the showyard question settled? Was it to be in London or in some country place? Upon the decision of that question a very great deal of the future depended. He had very little doubt as to the question of the show coming near London. He spoke after some experience, being a director of the Royal Agricultural Hall Company; and he knew how difficult it was to induce people in London to visit agricultural shows in the teeth of the many other attractions provided for Londoners. If they went to a small town, or even to cities like Birmingham, Manchester, or Leicester, the show of the Society was the chief thing, and the whole town was concerned in and attracted to it. He hoped, therefore, that the Committee would exercise the very greatest caution as to whether the show was held near London or not. The whole matter was one upon which opinions were so much divided that they could not expect to give universal or great satisfaction. They hoped, however, that the Committee would do the best they could for the Society; but, in any case, a very great responsibility rested upon them.

Surgeon-Lieut.-Colonel INCE said that the thanks of the members were due to the gentleman who had just addressed them upon the most important question which could be raised in connection with the Royal Agricultural Society. The Report began by telling them that the Society had lost a considerable number of its members, and went on to say that its funds were 8,000*l.* to the bad, chiefly through the loss on the show at Maidstone, which, as a Kentish man himself, he deplored very much.

That being so, the future of the Society's shows required most serious consideration. He thought they might have every confidence in the Council, which was composed of men of experience and great knowledge of the subject. At the same time, he thought that, in a matter of such moment, some steps ought to be taken to consult the 10,000 members of the Society before a final decision was arrived at.

Lord BARNARD said that, assuming for the moment that the question of the permanent location of the show was decided upon, he should like, in connection with that subject, to ask the Council whether it would not be possible, by some means or other, to prevent their Society from becoming almost entirely central and fixed. The suggestion he had to make to the Council was that they should hold meetings, not shows, in connection with the Society. These might co-operate, perhaps, with county or local shows by giving special prizes, or in some other way, so that the Society might continue to exert its influence throughout the length and breadth of the land, as in the past, but without the expense of local shows.

Mr. L. H. B. SHAND said, with reference to the question of milk being carried in churns, it was known to a good many members that the British Dairy Farmers' Association had conducted some investigations, and that they were unable, after a very large number of experiments, to trace tubercle bacilli in the milk. At the same time, when the milk reached Liverpool and Manchester, the investigations concurrently carried on by the Corporations of those cities had discovered the bacilli, which were not in the milk when it left the farm. Would it be possible for the Council to institute experiments with a view to ascertaining if milk sent in churns was contaminated by the tubercle bacilli at the time when it left the farm, or whether such contamination was found when it arrived at its destination? It seemed to him that the milk was put in a dirty place, on dirty platforms, and thus became contaminated. If the Society were to investigate that subject, some useful results might follow.

**Vote of Thanks to Chairman.**

Lord BARNARD, in proposing "That a hearty vote of thanks be accorded to Sir John Thorold for his conduct in the Chair that day," said it was somewhat appropriate that the task should be allotted to him, seeing that it was during Sir John Thorold's occupancy of the Presidential Chair that the Society's Country Meeting was held in his (Lord Barnard's) neighbourhood at Darlington. He was at the same time Chairman of the Local Committee; and, although in consequence of a severe illness he was unable to take any active part in the show itself, he had had ample opportunity of judging of the capability of their then President, Sir John Thorold, and he was perfectly confident that they would all agree with him that they could not possibly have had, in the unavoidable absence of the Prince of Wales, a more able Chairman of their proceedings that day.

Mr. S. H. COWPER-COLES said he had much pleasure in seconding the resolution, which was put by the SECRETARY, and carried unanimously, amidst applause.

The CHAIRMAN, in reply, said he had to thank Lord Barnard and Mr. Coles for the kind way in which they had alluded to his services in the Chair, which, owing to the invariable courtesy extended at these meetings to the Chairman, had not been difficult. The various subjects that had been mentioned that day would be referred to the Council for their consideration. Every member of the Council was most anxious that whatever decision might be come to by the Committee the show should be a success. He was sure they would not expect that any decision should be come to until every avenue had been examined, and it must therefore be some time before anything could be settled. He thought it was apparent to them all that a great Society like theirs must trust the Council to do the best they could for the members. They all regretted giving up the migratory shows, but they did not wish that the Society should lose its usefulness by continuing to hold shows under the present conditions.

The proceedings then terminated.

## MEMORANDA.

**ADDRESSES OF LETTERS.**—All letters on the general business of the Society should be addressed to "The SECRETARY, Royal Agricultural Society of England, 13 Hanover Square, London, W." Letters addressed to officials of the Society by name are liable to be delayed.

**TELEGRAMS.**—The Society's registered address for telegrams is "Practice, London." *Replies by Telegraph cannot be sent unless paid for in advance, and cannot be guaranteed in any case.*

**TELEPHONE NUMBER.**—3675, "Gerrard."

**OFFICE HOURS.**—10 to 4. On Saturdays, 10 to 2.

**GENERAL MEETINGS** in London : Thursday, December 12, 1900, and Wednesday, May 22, 1901, at noon, at the Society's house, 13 Hanover Square, W.

**MONTHLY COUNCIL** (for transaction of business), at noon on the first Wednesday in every month, excepting January, September, and October : open only to Members of Council and Governors of the Society.

**SUBSCRIPTIONS.**—1. *Annual.*—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June.

2. *For Life.*—Governors may compound for their subscriptions for future years by paying on election, or at any time thereafter, the sum of £50, and Members by paying £15. Members elected before 1890 may compound at any time on payment of £10 in one sum ; and Members elected in or subsequently to 1890 may compound for the same amount after the payment of ten annual subscriptions. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose payments are not in arrear, may compound for future annual subscriptions, that for the current year inclusive, by a single payment of £35 for a Governor, and £5 for a Member. No Governor or Member can be allowed to enter into composition for life until all subscriptions due by him at the time shall have been paid.

No Governor or Member whose subscription is in arrear is entitled to any of the privileges of the Society.

All Members of the Society are, under the Bye-laws, bound to pay their annual subscriptions until they shall withdraw from it by notice in writing to the Secretary.

**PAYMENTS.**—Subscriptions may be paid to the Secretary, either at the office of the Society, No. 13 Hanover Square, London, W., or by means of crossed cheques in favour of the Secretary, or by postal orders, made payable at the Vere Street Office, London, W. When making remittances it should be stated by whom, and on whose account, they are sent. All Cheques and Postal Orders should be crossed "London and Westminster Bank, St. James's Square Branch."

On application to the Secretary, forms may be obtained for authorising the regular payment, by the bankers of individual members, of each annual subscription as it falls due. Members are particularly invited to avail themselves of these Bankers' orders, in order to save trouble both to themselves and to the Society. When payment is made to the London and Westminster Bank, as the Bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the bankers' book may be at once identified, and the amount posted to the credit of the proper person. No coin can be remitted by post, unless the letter be registered.

**JOURNAL.**—The Parts of the Society's Journal are (when the subscription is not in arrear) forwarded by post to Members, or delivered from the Society's Office to Members or to the bearer of their written order.

The back numbers of the Journal are kept constantly on sale by the publisher, Mr. JOHN MURRAY, 50A Albemarle Street, W.

**NEW MEMBERS.**—Every candidate for admission into the Society must be nominated by a Governor or Member, and must duly fill up and sign an application for Membership on the appointed form. Forms of Proposal may be obtained on application to the Secretary, who will inform new Members of their election by letter.

# ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

## Proceedings of the Council.

WEDNESDAY, JUNE 20, 1900.

(IN THE SHOWYARD AT YORK.)

SIR JOHN H. THOROLD, BART. (TRUSTEE), IN THE CHAIR.

### Present:

*Trustees.*—Sir Walter Gilbey, Bart.,  
Sir John H. Thorold, Bart.

*Other Members of Council.*—Mr. Alfred Ashworth, Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Col. J. F. Curtis-Hayward, Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. W. Frankish, Mr. Hugh Gorringe, Mr. R. M. Greaves, Mr. James Hornsby, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. J. E. Sansome, Mr. H. P. Ryland, Mr. G. H. Sanday, Mr. A. J. Smith, Mr. E. W. Stanyforth, Mr. Garrett Taylor, Mr. E. V. V. Wheeler, Mr. J. C. Williams, Mr. C. W. Wilson.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Mr. F. S. Courtney, Consulting Engineer; Mr. J. E. Compton-Braconbridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, C.B.

Apologies for non-attendance were received from the Duke of Bedford, Earl Spencer, K.G., Col. Sir Nigel Kingscote, K.C.B., Mr. J. H. Arkwright, Mr. Henry Smith, and Mr. Martin J. Sutton.

In the unavoidable absence at Newcastle of H.R.H. the PRESIDENT, SIR JOHN THOROLD, Bart. (Trustee),

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was, on the motion of Mr. G. H. SANDAY, called to the Chair.

The Minutes of the last Monthly Meeting of the Council, held in London on May 31, 1900, were taken as read and approved.

### Report of Finance Committee.

Mr. FRANKISH presented a report from the Finance Committee, recommending payments of accounts amounting to 3,197*l.* 3*s.* 8*d.*

### Votes of Thanks in connection with York Meeting.

On the motion of Mr. PERCY CRUTCHLEY (Honorary Director), seconded by Mr. SANDAY (Senior Steward of Implements), it was unanimously resolved:

That the best thanks of the Society are due, and are hereby tendered—(a) to the York City and County Banking Company, York, for the efficient assistance rendered by them during the York Meeting; (b) to the City of York Police, for the efficient assistance rendered by them in connection with the York Meeting; (c) to the North-Eastern, Great Northern, and Lancashire and Yorkshire Railways, for the facilities afforded in connection with the York Meeting; (d) to the Wardens and Pasture Masters of the Knavesmire, for the use of the ground and for the facilities afforded in connection with the Meeting; (e) to the St. John Ambulance Association, for the efficiency of the ambulance arrangements in the Showyard during the York Meeting; (f) to Messrs. Brown Bros. & Taylor, of 43 Coney Street, York, for decorating and

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furnishing the Royal Pavilion; (g) to Messrs. William Rose and Co., Metropolitan Works, Manchester, for the provision of Fire Engines and for their efficient arrangements in connection with the Fire Station in the Showyard; (h) to the Officials of the York Post Office for the efficient postal and telegraphic arrangements; (i) to Mr. G. J. F. Newey, for the supply of clocks at entrances, pavilions, and offices; (j) to Messrs. Ransomes, Sims, and Jefferies, Ltd., of Ipswich, for the loan of a steam engine for supplying motive power to the Dairy; and (k) to the York Race Committee, for the facilities afforded by them in connection with the Meeting and for the loan of turnstiles.

Letters of thanks were also ordered to be addressed to various other firms who had rendered assistance in connection with the York Meeting.

On the motion of Mr. STANYFORTH, seconded by Mr. CRUTCHLEY, special votes of thanks were passed to Lord Wenlock for his cordial co-operation and for the assistance of his estate staff in connection with the Society's trials of Implements and the preparations for the show generally, and to Mr. F. E. Walker, Lord Wenlock's Agent, for the invaluable help which he had given throughout the preparations for the Show and during the show itself to the Society's Stewards and Officials.

On the motion of Mr. CRUTCHLEY, seconded by Mr. SANDAY, a letter was ordered to be addressed to the Chief Commissioner of Police after the conclusion of the Meeting, conveying the appreciation of the Council of the very efficient services rendered by the Detachment of the A Division of the Metropolitan Police at the York Meeting.

### Veterinary Reports.

Sir GEORGE BROWN presented a report upon the veterinary examination of animals before entering the Showyard, stating that it was found necessary to reject eight cattle and seven horses. The cattle were all suffering from skin disease in different stages, including sarcoptic mange, ringworm, and an eruptive disease due to the presence of immense numbers of lice. Of the seven horses four were suffering from incipient strangles, two from skin diseases, and one from catarrh and fever.

Sir GEORGE BROWN presented a further report on the veterinary examination (under Regulation 48) of

the Horses selected by the Judges, which stated that 250 horses had been examined by the 12 Inspectors engaged in the work. Nineteen horses were rejected as unsound, viz., eight for whistling or roaring; three on account of cataract; two were affected with sidebone; two were rejected for ringbone; two for spavin; one for stringhalt; and one for unsound feet.

### Protests.

A protest against the award of the First Prize to No. 464 in Class 56, on the ground that such animal was not eligible to receive a prize, "being over 14 hands in height," was not sustained, Professor Hobday having measured the animal, and found it to be exactly 14 hands high. The general question of the arrangements for the measuring of horses in the Classes for which limits of height were announced in the prize sheet, was referred to the Veterinary Committee for consideration. A protest by the Darby Land Digger Company against the First Prize being awarded in Class II. for Implements (Self-Moving Steam Diggers) "without further exhaustive trials of both competing machines" was considered; but on the motion of Mr. SANDAY, seconded by Mr. RYLAND, it was resolved that the protest be not sustained.

### New Member of Council.

On the motion of Mr. FRANKISH, seconded by Mr. HORNSBY, Mr. John Howard Howard, of St. Mary's House, Bedford, nominated by the Committee of Selection at the last meeting of the Council, was elected a Member of the Council in the room of the late Mr. Dan. Pidgeon.

### International Congress at Paris.

A preliminary report by Mr. Martin J. Sutton as to the International Congress on Agricultural Education held in Paris from June 14 to 16, was submitted by the Secretary, and referred to the Education Committee for their consideration. Letters were read from the Société des Agriculteurs de France and from the Commission Internationale de l'Agric.

culture on the subject of the International Agricultural Conferences and Congress to be held at Paris, in the first week of July. As both Earl Spencer and Earl Egerton of Tatton, who had been nominated by the Committee of Selection at the March Council as the Society's delegates, now found it impossible to be present at these Conferences, it was resolved on the motion of Mr. GARRETT TAYLOR, seconded by Mr. CRUTCHLEY, that Sir Ernest Clarke be requested to attend as representing the Royal Agricultural Society.

### Country Meeting of 1901.

On the motion of Mr. SANDAY, seconded by Mr. FRANKISH, a General Cardiff Committee was appointed to consist of the whole Council, with a limited number of representatives of the Cardiff Local Committee to be nominated by the Mayor of Cardiff. The first meeting of the Committee was fixed for Wednesday, August 1, 1900, at 11 a.m.

The Council then adjourned its Ordinary Meeting until Wednesday, August 1, 1900, at 12 noon, at 13, Hanover Square, W.

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## SPECIAL MEETINGS OF THE COUNCIL,

HELD IN THE SHOWYARD DURING THE YORK MEETING.

Special Meetings of the Council were held in the York Showyard on Monday, June 18, and Friday, June 22.

MONDAY, JUNE 18, 1900.

(Col. Sir NIGEL KINGSCOTE, K.C.B. (Trustee) in the Chair.)

Mr. CRUTCHLEY (Honorary Director) reported that owing to the illness of one Judge and the absence of another, he had, with the approval of the Chairman of the Stock Prizes Committee, found it necessary to ask Mr. John Wreghitt, of Easthorpe, Market Weighton, Yorks., to act as a Judge of Hackneys, and Mr. Joseph Beach, of The Hattons, Wolverhampton, to act as Judge of Shropshire Rams. These appointments were confirmed. A protest against the award of the First Prize in Class I., for Implements (General Horse-Power Cultivators) was read, and the Consulting Engineer replied to the various technical points raised by the protest. It was resolved that the protest could not be sustained. Other details connected with the administration of the Showyard were discussed and settled.

FRIDAY, JUNE 22, 1900.

(Mr. G. H. SANDAY (Senior Steward of Implements) in the Chair.)

A protest against the award by the Judges of Miscellaneous Implements of the Society's Silver Medal for an Elevator attached to a Harvester "without a trial of the Implement under practical conditions" was ordered to be referred to the Implement Committee for consideration and report. The question as to whether it was desirable to modify or revise the regulations already published, so as to admit of Absorption Machines competing for the prize of 15*l*. offered for Ice-making Plant for competition at the Society's Cardiff Meeting of 1901, was also referred to the Implement Committee for consideration.

Mr. FOSTER (Senior Steward of Stock) made a number of suggestions relating to his department, and these were referred to the Showyard Works Committee for consideration in connection with the arrangements for next year's Show.

Sir GEORGE BROWN presented a certificate to the effect that no outbreak of contagious or infectious disease had occurred amongst the animals exhibited in the Showyard.

The Council then adjourned until Wednesday, August 1, 1900, at noon.

WEDNESDAY, AUGUST 1, 1900.

EARL CAWDOR (PRESIDENT) IN THE CHAIR.

**Present:—**

**Trustees:—**General Viscount Bridport, G.C.B., Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., Sir John H. Thorold, Bart.

**Vice-Presidents.**—The Earl of Coventry, the Earl of Feversham, the Rt. Hon. Sir Massey Lopes, Bart., Lord Moreton, the Hon. Cecil T. Parker, Sir Jacob Wilson.

**Other Members of Council.**—Mr. J. H. Arkwright, Mr. R. C. Assheton, Viscount Baring, Mr. George Blake, Mr. J. Bowen-Jones, Lord Brougham and Vaux, Mr. Victor C. W. Cavendish, M.P., Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Colonel Curtis-Hayward, Mr. A. E. W. Darby, Mr. J. Marshall Dugdale, Mr. W. Frankish, Mr. Hugh Gorringe, the Marquis of Granby, Mr. R. M. Greaves, Mr. James Hornsby, Mr. John Howard Howard, Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. P. A. Muntz, M.P., Mr. Alfred E. Pease, M.P., Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Henry Smith, Mr. E. W. Stanyforth, Mr. R. Stratton, Mr. Martin J. Sutton, Mr. Garrett Taylor, Mr. J. P. Terry, Mr. R. A. Warren, Mr. E. V. V. Wheeler, Mr. J. C. Williams.

**Officers:—**Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, C.B.

The following members of the Cardiff Local Committee were also present:—The Mayor of Cardiff (Mr. Councillor Brain), the Town Clerk (Mr. J. L. Wheatley).

Apologies for non-attendance were received from the Earl of Derby, K.G.,

the Earl of Ravensworth, Mr. Alfred Ashworth, Mr. S. P. Foster, Mr. A. J. Smith, Mr. Charles Whitehead, and Mr. C. W. Wilson.

**Order of Business.**

The PRESIDENT, in taking the Chair for the first time, said that he had assumed the responsibility of specially summoning the Council earlier in the day than usual, as they had not only the ordinary business of the Society to transact, but had also to consider and settle some important matters connected with the question of the proposed permanent showyard for the Society. He therefore suggested that they should first deal with formal business, then settle the date of the Cardiff meeting of next year, and afterwards go into Committee of the whole Council to discuss a report which had been prepared by the Special Show Committee at their meeting held on the previous Monday (July 30). When the discussion on this report had been completed, the Council would resume for the consideration of the reports of the various Standing Committees.

This course having been agreed to, the Minutes of the last Ordinary Meeting of the Council, held on Wednesday, June 20, were taken as read and approved, and the Minutes of the Special Councils held in the York Showyard on Monday, June 18, and Friday, June 22, were read and confirmed.

**Letter from H.R.H. The Prince of Wales.**

The SECRETARY read the following letter, which had been addressed to him by His Royal Highness the Prince of Wales:—

Marlborough House, Pall Mall, S.W.,  
July 8, 1900.

Dear Sir Ernest Clarke,—On the completion of my year of office as President of the Royal Agricultural Society for the fourth time, I am anxious to place on record my high sense of the valuable assistance

and support given to me throughout the year by the Council and Officers of the Society, and to express to them and to the general body of Members my sincere thanks for the cordial goodwill and loyal attachment which all those connected with the Society have shown to me during my long association with it as a Member of the Council.

I remain, yours truly,

(Signed) ALBERT EDWARD P.  
To Sir Ernest Clarke.

The PRESIDENT, in moving that His Royal Highness's gracious letter be entered on the Minutes, said that the Society's very grateful thanks were due to His Royal Highness the Prince of Wales for accepting the duties of their President, and for the continued interest which His Royal Highness manifested in the work of the Society. Since the receipt of the letter a very heavy bereavement had fallen upon the Royal Family in the death of H.R.H. the Duke of Saxe-Coburg-Gotha, K.G. (Duke of Edinburgh), who had been a Governor of the Society since 1884. He thought they would be wanting in their duty if they did not express their respectful sympathy with Her Majesty the Queen and the other members of the Royal Family upon this very sad occasion; and he desired, therefore, to move from the Chair that a humble Address of condolence be submitted to Her Majesty the Queen, assuring Her of the earnest and respectful sympathy of the Society with Her Majesty in her affliction.

The President's motion was seconded by the Earl of COVENTRY, and carried unanimously.

### **Election of New Members.**

The election of the following sixty-four Members was then proceeded with:—

BARBER, W. Henry..Culham Court, Henley-on-Thames.  
BARRON, Samuel..Dunsfold, Godalming.  
BAYLY, Richard..Torr, Plymouth.  
\*BLACKETT, C. K...Toulston, Tadcaster.  
BOOTH, Thomas..Shenstone Hall, Lichfield.  
\*BROTCHER, George..Easington Estate Offices, Hinderwell, R.S.O.  
BROWN, George..1 Roe Street, Liverpool.  
BURDON, Herbert L. O...Newcourt, Hereford.  
CATTLEY, Wentworth E...Shobden, Chipstead, Surrey.  
CAVE-BROWNE-CAVE, R...Barton Court, Colwall, Herefordshire.  
CHAPMAN, Joseph J...17 St. Hilda's Terrace, Whitby.

CHARLES, H. E. Audley..Orgreave House, near Lichfield.  
CHARLTON, W. L...Muskham Grange, Newark-on-Trent.  
CHRISTY, R. W...Little Boyton Hall, Chelmsford.  
CORBETT, E. W. M...Pwllypant, Cardiff.  
CRAIK, George, M.R.C.V.S...Nether House, Alnwick.  
DENTON, John B...Huby, near Leeds.  
DIXON, Sir Raylton..Gunnergate Hall, Marton, R.S.O., Yorks.  
DRUMMOND, Hon. George A...Montreal, Canada.  
EASTMAN, Adolfo..Valparaiso, Chili, South America.  
ELLERSHAW, Arthur..Scarborough.  
FIRTH, C. H. Bramley..Aahwicke Hall, Marshfield, Chippenham.  
GARNETT, Wm...Waddow Lodge, Clitheroe.  
GODSAL, Edward H...Hawera, New Zealand.  
HALL, C. O...Hywell Castle, Stocksfeld-on-Tyne.  
HALLAM, J. B...Orgreave Hall, Handsworth, near Sheffield.  
HARLAND, Edward..The Sycamores, Cottingham, E. Yorks.  
HARRIS, Edward C...Bryn Towy, Carmarthen.  
HARRIS, Dr. F. Rutherford..Llangibby Castle, Usk, Mon.  
HARROWING, J. H...Turnerdale Hall, Ruswarp, near Whitby.  
HATCH, Edgar L...Crown Wharf, 5 Upper Thames Street, E.C.  
HAWKING, William..Treblekyes, Helperby.  
HAPE, Walter..Heyroun, Chaucer Road, Cambridge.  
HUMBLE, C...Framlington Place, Newcastle-on-Tyne.  
HUTCHINSON, Cecil F...Bilton Dene, Harrogate.  
JEAVONS, Howard..Chapel Ash Farm, Wolverhampton.  
JONES, Thomas..Llanfair Grange, Llandovery.  
JONES-BALME, F. E. T...Brier Knowl, Mirfield.  
LEECH, Mrs...4 Kensington Palace Gardens, W.  
LODER, Reginald B...Maidwell Hall, Northampton.  
MACANDREW, Kenneth..The Cottage, Walton Heath, Epsom.  
MANLEY, Edmund H...Crewe.  
MARKS, James..Hunslet, Leeds.  
McDOUGALL, Isaac..Bossington, Moorfield Road, West Didsbury, Manchester.  
MEAKIN, G. Elliot..Creswell Hall, Stafford.  
MILNE-REDHEAD, A. C...Holden Clough, Clitheroe.  
MOORE, Arthur C...23 Essex Street, Strand, W.C.  
NASH, Maynard..P.O. Box 573, Cape Town, South Africa.  
OWEN, George..118 Blackfeares Road, Salford, Manchester.  
PALMER, R. Stuart..Birdsall Grange, York.  
PEARSON, W. O...49 Castle Street, Liverpool.  
PORTEOUS, Major John J...94 Piccadilly, W.  
REED, Wm. F...Preston, North Shields.  
SHIELD, Robert..13 Cardigan Terrace, Heaton, Newcastle-on-Tyne.  
SMEDLEY, Martin..Peat Pits Farm, Bradfield, Sheffield.  
SOUTHAMPTON, Lord..Brigstock, Northants.  
THOMAS, D. H...Starling Park, Carmarthen.  
THOMPSON, W. J...Board of Trade, Toronto, Canada.  
THORNYCROFT, John A...Tamhorn Park, Lichfield.

\* Reinstated under Bye-law 12.

TURNER, Herbert...Corn Hall, Bures, Suffolk.  
 TYSON, George...Mayfield Stud, Halifax.  
 UPTON, Edward...Cralle Place, Warbleton,  
 Sussex.  
 WALKER, Sir J. Heron, Bart...Sand Hutton,  
 York.  
 WIGSTON, Arthur E...The Creaseys, Mundes-  
 ley, Norfolk.

### New Member of Council.

Sir JOHN THOROLD, as Chairman of the Committee of Selection, introduced to the Council Mr. John Howard Howard, of St. Mary's House, Bedford, who attended for the first time as a Member of Council.

### Cardiff Meeting of 1901.

Sir WALTER GILBEY reported that the General Cardiff Committee had been constituted of the whole Council, together with the following members of the Local Committee:—

THE MAYOR OF CARDIFF (Mr. S. A. Brain).  
 FORREST, Mr. Robert...St. Fagans, Cardiff.  
 HOWELL, Mr. James...St. Mary Street, Cardiff.  
 KNOX, Mr. Edward...Estate Office, Margam  
 Park, Port Talbot.  
 WILLIAMS, Mr. George E...Llanrumney Hall,  
 Cardiff.  
 ALEXANDER, Mr. David T...High Street,  
 Cardiff.  
 LEWIS, Mr. Henry...Greenmeadow, Tongwyn-  
 laia, Cardiff.  
 CORBETT, Mr. E. W. M...Castle Street, Cardiff.  
 WHEATLEY, Mr. J. L., Town Clerk (Hon.  
 Sec.).

The Committee recommended that the Cardiff Meeting should open on the morning of Wednesday, June 26, and should close on the following Monday, July 1st, 1901. It had been decided that the Implement Yard should not on this occasion be opened previous to the opening of the rest of the Show. The prices of admission to the Showyard on each day would be considered at the meeting of the Committee in November next.

### Special Show Committee.

The Hon. CECIL T. PARKER (Chairman) then presented the following Report of the Special Show Committee, prepared at their meeting held on July 30, 1900:—

1. The Committee held a further meeting on Monday, July 30, in order to consider the various proposals and suggestions which have been received by the Society from different sources as to the locality for the proposed permanent Showyard for the Society.

2. Schemes in various stages of development are reported to be under consideration in several places; but most of them appear

to be to a certain extent dependent upon the Society first deciding for itself whether it will go to the particular place, in which case local efforts may be expected towards the acquisition of the site suggested.

3. Under these circumstances it appears to the Committee that, before going further, it is necessary to ask the Council to decide whether, in their judgment, the site of the Society's permanent Showyard should be in the Metropolis or in the provinces.

4. After careful consideration of the whole matter, the Committee have decided by a majority that, in their opinion, it is desirable to obtain a site in the neighbourhood of London for the purposes of the Society's permanent Showyard.

(Signed) CECIL T. PARKER,  
 Chairman.

July 30, 1900.

The Hon. CECIL T. PARKER then moved, pursuant to the general resolution passed by the Council, on the motion of Mr. Pell, on May 30, 1900:—

That the Report of the Special Committee now presented be considered in Committee of the whole Council.

This was seconded by Mr. CRUTCHLEY and agreed to. A long debate on the report ensued in Committee, of which the following is a summary:

The Hon. CECIL PARKER, in moving the adoption of the report, said that out of a great many sites which had been suggested for their consideration, the Committee had selected several of the most likely in the provinces, and had obtained information as to the advantages and disadvantages of each neighbourhood and ground for the purposes of the Society's show. After weighing the *pros* and *cons*, he, with the majority of the members of the Committee, had come to the conclusion contained in paragraph 4 of the report. Two sites had already been offered in the neighbourhood of London, and when the time came, after the Council had arrived at a decision on the main point, the Committee would, of course, go thoroughly into the question of accommodation and expense. The real point now at issue, on which it was necessary to ask the Council to come to a conclusion that day, was whether they desired to have the Society's permanent Showyard in the Metropolis or in the provinces.

Mr. PERCY CRUTCHLEY, in seconding the resolution, said he thought the time had come when it was necessary for them to narrow the

issue down to the question as between London and the provinces. It was now six months since the report of the Special Committee had been made public, and they had had the advantage of important criticism—both public and private. He did not think that during those six months it was at all probable that any sites had been overlooked which were likely to be suitable for the Society's requirements; and if the Council spent too much time in deliberating on the matter, it was more than probable that several of the sites which they might now obtain would be built over. He thought it only fair, seeing that several towns in the provinces were preparing or contemplating schemes for the development of sites, that the Council should make up their minds on this point before proceeding further, so as to save the towns needless trouble and expense.

After remarks by Mr. PELL and Mr. RYLAND,

The Earl of COVENTRY said the question now to be decided marked a very important period in the history of the Society. Many of them regretted very much the necessity for abandoning the system of migratory shows, which had done so much good work during the past sixty years. They had, however, to consider the future of the Society, and he had come to the conclusion that it was quite impossible for them to continue the present system. The best thing, undoubtedly, to do was to have a permanent and fixed Showyard in which to hold their annual shows, and he (Lord Coventry) certainly thought that the neighbourhood of London was the best for the purpose. London was a great and populous centre, to which people from all parts of the country would flock.

Mr. G. H. SANDAY, as one of the minority opposed to the establishment of the Society's permanent Showyard in the neighbourhood of London, said that in his opinion the information which the Special Committee had been able to give to the Council was not such as to enable them to come to a final decision on the subject that day. He had himself, at considerable trouble, visited

sites at Birmingham, Leicester, and Nottingham, and had seen three others near London. He thought the time was premature for the Council to decide so momentous a point as had been brought before them that day, and he would urge upon them not to settle the matter hurriedly.

Mr. P. ALBERT MUNTZ, M.P., said that so many important points were involved that, unless members had detailed information as to the various sites suggested in different parts of the country, they could not come to a right decision as to the merits and demerits, the suitability or unsuitability, of any particular place. He suggested that an expert should be employed to inspect and report upon the different sites which had been offered. The site chosen should not be on one line of railway, but should be so situated that various lines converging towards a centre should provide the necessary conveniences of transport from all parts of the kingdom. The town of Derby, to his mind, best fulfilled these requirements, though Leicester and Nottingham were both good. Upon the proper consideration of this question depended the future prosperity or failure of the Society.

The Marquis of GRANBY thought they should have had more information laid before them as to the various sites, and thus be able to judge for themselves, as to land, soil, position, and the like, as between the country and London. He should like to have the fullest information both as to the sites which had been mentioned and those which had not been referred to.

The Hon. CECIL PARKER, interposing, said that it was impossible to give such detailed information as had been asked for, because the Corporations and other bodies with whom they had been in communication could not be expected to go to the expense and trouble of elaborating a scheme until they knew whether the Society would go to their neighbourhood or not.

Sir JACOB WILSON explained that his reason for not being able to vote with the Chairman of the Special Show Committee was that, in the ab-

sence of certain information which he required, he did not think it desirable for their Society to come into the neighbourhood of London. It was, he thought, due to those districts in the country which had furnished information as to sites for a permanent Showyard that, if the Council were invited to come to a decision on the point, they should only do so after the fullest consideration of all the details which it was possible to collect. This had up to the present not been done; and he confessed that, on looking back over the statistics of shows held in the neighbourhood of London, he did not find the prospect very encouraging. It had been said that a great number of people visited the Kilburn Show, but then that show was open three days longer than the customary period. There was more than one site available in London which he believed to be admirable and in every way advantageous to the Society. But he would remind them that they were about to come to a very important and momentous decision. When they had decided where to go, there could be no turning back again; and if they went to a London district, and it should turn out a failure—and he knew several enterprises in London which had turned out failures—the Society would be in a worse position than at the present time. Taking a broader view of the question, they must remember that the original intention of the Royal Agricultural Society was to benefit the Agriculture of the country, and even if they selected a site in the Midlands in preference to a migratory Show, he thought the Society would run the risk of losing the character of what is known as "The Royal" in the eyes of a great many people, though it might still more or less maintain its agricultural side. But if they came to London he feared that they would lose both, and that the Society would be no longer either Royal or agricultural, but would develop into a huge implement and horse show. Horse shows, he knew, attracted as exhibitors wealthy breeders of horses, but he thought the Society would lose its hold upon the cattle and sheep breeding interests. It had been said that the breed societies would come to

their rescue, but he was not altogether sure of that. There were breed societies and breed societies. It was possible that some of the wealthy societies might place at their disposal a certain amount of money to swell the prize sheet, but in return they would expect to have a voice in the distribution of the prizes.

Mr. SANDAY then formally moved the following amendment (which was seconded by Mr. MUNTZ) to the motion for the adoption of the report:—"That, in the absence of full information with reference to all the sites offered, the time for the final decision of place or district has not arrived, and that the question be referred back to the Special Committee for further consideration and report."

Mr. MARSHALL, speaking as a member of the Special Show Committee, said that, in considering the important question at issue, his colleagues and himself had had their doubts and misgivings upon various points, and it was only after the whole matter had been carefully thought over that they had arrived at a certain decision. For himself, regarding London as the "Hub of the Universe," he was decidedly of the opinion that the metropolis was the place in which to locate their permanent Showyard.

Mr. MARTIN SUTTON said there were three questions which he would like to ask: (1) Whether the resolution which was carried by 38 votes to 4 at the meeting of the Council last March did not contain, as an integral part of that resolution, the recommendation that any permanent Showyard would be situated near the centre of England? (2) If the Committee now withdrew that recommendation, was not the question of abandoning the migratory shows still open to reconsideration? (3) Was not this a proper moment to consult their Members by asking them, when the next Journal was posted, to forward to the Society on a printed form their views for or against a permanent Showyard; and in the event of their approving a permanent Showground, to state their opinion as to whether that Showyard should be near the Metropolis, or in the Midlands?

Mr. CRUTCHLEY quoted, with reference to Mr. Sutton's first question, the following paragraph from the report of the Special Committee on the Society's Show system, presented to the Council at its meeting held on February 7, 1900, as showing that the Council, by its adoption of that report, did not commit itself to the selection of any particular neighbourhood for a permanent site for the Society's annual Show :

31. Taking into consideration all the facts of the case, the Committee have arrived at the conclusion that, if the Society's Shows are to fulfil their proper function in the future, without an unwarrantable drain upon the Society's general resources, it would be desirable that, if possible, they should be held upon a permanent location near some large town (preferably in the centre of England), which would be convenient for railway access from all parts of the country. In fact, the endeavour of the Society in the future should be to bring the people to the Show, and not the Show to the people.

The PRESIDENT informed Mr. Sutton that the answer to the second question was "No;" and in reply to the third question, said that the report of the Special Committee had been adopted by the Council on March 7 last, after a very full discussion, by thirty-eight votes to four, and the Committee's recommendations were embodied in the report approved by the general meeting of members held on May 22 last. In his (Lord Cawdor's) opinion, the proper way of consulting the members of the Society had thus been taken, and he thought it very undesirable that the unusual course suggested by Mr. Sutton should be adopted.

Mr. PELL was of opinion that the Committee had placed very clearly before the Council the issue as between a metropolitan Show and one in the country. Personally, he was not in favour of the metropolis. He would dismiss from his mind the site question, which, however, was not a trifling one, and turn to other worthy objects which the Society had to consider under the terms of its charter—the education of the agricultural labourer, for instance. They were called upon to educate the labourer, and by their migratory shows had undoubtedly been instrumental in doing so. But he questioned whether the agricultural labourer would come

to a metropolitan Show. He would remind them that London bred no cattle, and he was not aware of any great agricultural implement establishment existing in London, whilst in the Midlands they had a great deal of the best mechanical ability. Zeal and research in this respect undoubtedly lay nearer the North; while, with regard to transport, a perfect ganglion of railways converged towards Nottingham, Leicester, and Derby. He thought, again, that they already had enough Shows in London, and that by moving to the metropolis they would be making too much of the word "show." He was a very old member of the Society, and had its interests much at heart, and his opinion was that it would be unwise to bring themselves into competition with the attractions of London.

Sir NIGEL KINGSCOTE said that it had already been settled that the Society should have a permanent Showyard; and, that being so, he maintained that there was only one place suitable for such a Showyard, and that place was London. He had heard arguments that day in favour of Derby, Nottingham, and Leicester, as being more convenient for the transport of cattle and implements; but as regards passengers he differed altogether from the views which had been advanced, for it was a well-known fact that more excursion trains were run to London than to any other place in the kingdom. He believed the Society would lose 50 per cent. of its members by going permanently to the Midland counties. If they were to establish their shows in the metropolis, no doubt in the course of a few years they would get a walking population such as could not be hoped for at Nottingham or any other place. It was also a fact that some of the county and district Shows were seriously thinking of having a permanent Showyard; and, for the Royal Agricultural Society, London was the place above all others most suitable for their purposes. He was speaking in the presence of several shareholders of the Agricultural Hall Company, and they could testify how the wants of the Shire Horse Society, Smithfield Club, Dairy Show, &c., had outgrown the accommodation of

the Agricultural Hall. These societies would no doubt eventually come to the "Royal" showyard if it were established near the metropolis. As regards those who pleaded for more time for consideration, he might remind them that the evidence already collected proved conclusively that, wherever they might go in the provinces, they would be more or less under the control of the Corporations. He earnestly begged the Council to come to a decision that day to establish the Show in the neighbourhood of London. As regards actual sites, he had recently taken the opportunity of inspecting several in the neighbourhood of the metropolis. He would not, however, enter into the merits or demerits of these, but would content himself with remarking that, if they further postponed the consideration of the matter, they would probably fall between two stools and so obtain neither of the two sites which appeared to be most advantageous. He strongly urged the Council to make up their minds that day to come to London, and then the Special Committee could enter into details about sites.

Mr. MARTIN said that, as one of the oldest members of the Council, he regarded this question as the most important which had ever been brought before them; and it appeared to him that the Society had been brought into this dilemma chiefly from financial reasons. He submitted that, when the question of sites and other details connected with the Show were considered, the whole subject of the Society's financial administration should be reviewed.

Sir WALTER GILBEY said the subject which they had then to consider was whether the permanent Showyard should be in London or in the provinces, and he had never wavered in his opinion that London was the proper, indeed, the only, place to select for the site of their permanent Showyard. He wondered, if their Council meetings were held regularly at Derby or Leicester, whether they should have such full attendances as they were accustomed to see at Hanover Square. He thought not. They were accustomed to come to London, and no doubt the agricultural com-

munity could be educated to do the same. London was the centre of civilisation, and in his opinion it would be a very retrograde movement for the Society to establish itself in the provinces. If the Council decided to come to London, it would open up a new era in the Society's history. There were, of course, matters of detail which would have to be gone into, but the present was not the proper occasion. The main issue upon which they had to decide that day was whether the Show should be held in London or in the provinces, and he cast his vote strongly in favour of the metropolis.

Sir MASSEY LOPES, as a very old member of the Society and one who had taken great interest in it for many years, regretted exceedingly that the Council were obliged to make a resolution abolishing the country Shows; but as such a course seemed inevitable, he thought the metropolis would be the best place in which to select a site, and he therefore had no hesitation in supporting that view.

The Earl of FEVERSHAM remarked that Sir Jacob Wilson was the only member of Council representing the North of England who had spoken that day on the subject of a fixed site, and he (Lord Feversham), as also representing the North, would like to point out that there was a danger, by the Society establishing itself entirely in London, of alienating the sympathy and support of the North. He therefore suggested that at intervals of a few years the Society should hold a Show, in addition to its London Show, at some populous centre in the North of England, such as Manchester or Newcastle.

Mr. RANSOME, speaking as a representative of the agricultural implement department, said he could not help thinking that London was certainly the right place in which to locate their Show. He believed that, if the Showyard were situated in the metropolis, they would be more likely to retain their members generally than if they fixed upon a site in any of the large Midland towns, and they would also get a larger number of people to attend their Shows. In this latter respect he wholly agreed with what Sir Walter Gilbey had said.

It was necessary that the site to be chosen should be level and good dry soil, and well drained. It would also be essential to see that the several railway companies would provide adequate accommodation, and to ascertain from them beforehand that they would undertake to make all necessary arrangements for getting the cattle, machinery, and visitors quickly to and from the Show, from whatever parts of the country they might come.

Mr. STRATTON was of opinion that the matter now under their consideration was ripe for decision. (Hear, hear.) The only question with regard to the situation of their permanent Showyard now before them was the one of country *versus* London. He himself thought that this matter ought to have been decided long ago. It was a great mistake to have gone to the trouble and expense of making inquiries all about the country, unless there was some kind of certainty that the country would be chosen rather than the metropolis. He did not think it was at present a question of sites. The recommendation of the Committee was in effect that, provided a suitable site could be found, the neighbourhood of London should be selected. The real question, therefore, was whether they were going to make this a provincial Show—he would almost say a small provincial Show—or whether they were going to maintain it as the great national Agricultural Show of the world. (Hear, hear.) The great majority of exhibitors, he believed, infinitely preferred London to the provinces, and the majority of their visitors, he thought, would also prefer it, as well as the public generally. If they could not command a good attendance at a Show situated in a metropolis containing something like 5,000,000 people, it appeared to him a very odd thing. The question, to his mind, was not arguable for one single moment, and he was entirely in favour of their permanent Showyard being located in the metropolis and nowhere but the metropolis.

Viscount BARING was of opinion that the Council should have before them details with regard to other sites which had been suggested to the

Special Committee, before they came to a decision upon the question then before them.

Mr. TERRY supported the observations made by Mr. Stratton. The majority of the members of the Society with whom he had discussed the question (and they were many) were in favour of London. Most of those who were in favour of going to the provinces were those who appeared to him to have some local interest in the matter.

After some further discussion,

The PRESIDENT, in summing up the debate, said that what the Council were asked to do by the amendment of Mr. Sanday was to postpone any decision so that they might go fully into details as to sites. But six months hence they would be in no better position to arrive at a conclusion than they were that day. Corporations and other bodies interested in sites would not take the trouble to go into details until they had some assurance that the Society intended to come into their neighbourhood. What the Special Committee asked for was an expression of opinion by the Council as to whether on general grounds the site of the Society's future permanent Showyard should be in the neighbourhood of London or in a provincial town, and on this he would now ask them to vote.

A division being called for, there appeared thirty-four votes in favour of the Committee's report and twelve votes against.

The Division List was as under:—

#### AYES (34).

Mr. J. H. Arkwright.	Capt. W. S. B. Levett.
Mr. R. C. Assheton.	Sir Massey Lopes,
Mr. George Blake.	Bart.
General Viscount	Mr. Henry D. Mar-
Bridport, G.C.B.	shall.
Lord Brougham and	Mr. Joseph Martin.
Vaux.	Lord Middleton.
Mr. F. S. W. Corn-	Lord Moreton.
wallis, M.P.	Hon. Cecil T. Parker.
Mr. Percy Crutchley.	Mr. Alfred E. Pease,
Lient. - Col. Curtis-	M.P.
Hayward.	Mr. Albert Pell.
Mr. J. Marshall Dug-	Mr. J. R. Ransome.
dale.	Mr. Frederick Rey-
The Earl of Fevers-	nard.
ham.	Mr. Henry Smith.
Mr. W. Frankish.	Mr. E. W. Stanyforth.
Sir Walter Gilbey,	Mr. Richard Stratton.
Bart.	Mr. J. P. Terry.
Mr. James Hornsby.	Sir J. H. Thorold,
Mr. John Howard	Bart.
Howard.	Mr. B. A. Warren.
Col. Sir Nigel Kings-	Mr. E. V. V. Wheeler.
cote, K.C.B.	Mr. J. C. Williams.

## NOMES (12).

Viscount Baring.	Mr. R. M. Greaves.
Mr. J. Bowen-Jones.	Mr. C. S. Mainwaring.
Lord Arthur Cecil.	Mr. T. H. Miller.
Mr. Alfred Darby.	Mr. H. P. Ryland.
Mr. Hugh Gorringe.	Mr. G. H. Sanday.
Marquis of Granby.	Sir Jacob Wilson.

(Mr. Martin Sutton and Mr. Garrett Taylor did not vote.)

The Council then resumed, when, on the motion of the Hon. CECIL PARKER, seconded by Mr. CRUTCHLEY, it was resolved by the Council, *nem. dis.*, "That it is desirable to obtain a site in the neighbourhood of London for the purposes of the Society's permanent Showyard."

Sir JACOB WILSON asked for the indulgence of the Council in asking the question whether it would still be competent for the Special Committee to inform the Council what are the altered conditions under which a migratory Show might possibly have been held in the future in accordance with the requirements of the present day.

The PRESIDENT said that this point could not then be discussed.

The reports of the various Standing Committees were then presented and adopted as below:

## Finance.

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the period ended June 30, 1900, as certified by the Society's accountants, showed receipts amounting to 6,357*l.* 15*s.* 3*d.* and expenditure amounting to 9,133*l.* 2*s.* 11*d.* The accounts for the period ended July 28, 1900, showed receipts amounting to 2,655*l.* 11*s.* 2*d.* and expenditure amounting to 1,433*l.* 3*s.* 1*d.* Accounts amounting to 11,405*l.* 15*s.* 5*d.* relating to the York Meeting, and to 3,348*l.* 19*s.* 4*d.* arising out of the ordinary business of the Society, were presented and were recommended for payment. In order to meet the cheques that must be immediately issued, the Committee recommended that such an amount as might from time to time prove necessary be borrowed from the Society's bankers on security of the Consols inscribed in the Society's name. The quarterly statement of subscriptions, arrears,

and property, as at June 30, 1900, had been laid upon the table and approved.

On the motion of Sir NIGEL KINGSCOTE, seconded by Sir JOHN THOROLD, it was unanimously resolved:

That in view of the desirableness of winding up as early as possible the accounts for the York Meeting, authority be given to the President, the Chairman of the Finance Committee, and the Secretary to issue during the recess orders upon the Society's bankers for the payment of accounts connected with the Show.

## House.

Sir NIGEL KINGSCOTE (Chairman) reported that various accounts had been passed and recommended to the Finance Committee for payment, and other matters of detail connected with the House had been settled.

On the motion of Sir NIGEL KINGSCOTE, seconded by Sir JOHN THOROLD, the seal of the Society was authorised to be affixed to a new certificate of Harewood House Debenture Stock.

## Journal.

Sir JOHN THOROLD (Chairman) reported that a letter had been received from Dr. Fream resigning the editorship of the Journal, and the Committee recommended that Dr. Fream's resignation be accepted with regret. They had arranged with Dr. Fream that he should continue to act as Editor until the completion of the current volume, but that his responsibility for the Journal should cease at the conclusion of the present year. The consideration of the arrangements for the future conduct of the Journal had been postponed until after the recess. Part II. of the current volume (June 1900) had been duly published and despatched to the members. Various accounts for printing and for literary contributions to the Journal had been passed and referred to the Finance Committee for payment. The arrangements for the forthcoming number had been considered and approved, and the Committee recommended that articles on Welsh cattle and Welsh sheep should be prepared for inclusion in the Journal for 1901.

### **Chemical and Woburn.**

Mr. STANYFORTH (Chairman) reported that the Committee had made their annual visit of inspection to the Woburn Experimental Farm on July 11 last. They had decided that during the coming winter a trial should be made upon bullocks of the value of condiments as an addition to ordinary feeding materials; and that the sheep experiments for the winter should take the form of further testing the early use of mangels and the use of gorse. The Committee had under their consideration proofs of the first detailed report prepared by Dr. Voelcker upon the experiments conducted at the Pot Culture Station since its establishment under the Hills bequest in 1897. The report was of somewhat unusual length, but the Committee thought it extremely important that the results of the experiments to date should be published, and therefore decided to recommend that the report be published in full in the Journal. The Committee recommended that Mr. John Howard Howard be added to the Chemical and Woburn Committee.

### **Botanical and Zoological.**

Lord MORETON reported on behalf of Mr. Wheeler, Chairman of the Committee, that various alterations had been made in the Form of Order for Seeds which had been prepared for issue. Dr. Voelcker had reported progress in the experiments for the extermination of weeds, a further report on which would be presented in due course.

The Consulting Botanist and the Zoologist had presented reports on the detailed work of their Departments, the substance of which would appear in their Annual Reports at the end of the year.

### **Veterinary.**

The Hon. CECIL T. PARKER (Chairman) reported that a letter had been received from the Royal Veterinary College stating that, as the result of the recent examination of candidates for the Society's silver and bronze medals in cattle

pathology, Mr. Harry Thackeray, M.R.C.V.S. (care of Mr. Carless, V.S.; Stafford), had obtained first place, and Mr. Reginald John Collings, M.R.C.V.S., of Holmcote, Heavitree Road, Exeter, the second place. The Committee therefore recommended that the Society's silver medal be given to Mr. Thackeray and the bronze medal to Mr. Collings. The Committee also recommended that two classes be offered in connection with the horse-shoeing competition at the Cardiff Meeting for shoeing light and heavy horses respectively, the competition to be open, as before, to shoeing-smiths in the United Kingdom.

The following report had been presented by Sir George Brown:

**ANTHRAX.**—During the last four weeks 38 outbreaks, with 55 animals attacked, have been notified. The figures for the corresponding four weeks of last year were 33 and 46 respectively.

**GLANDERS.**—During the same period 80 outbreaks, with 114 animals attacked, have been reported, as against 73 outbreaks, with 134 animals attacked, in the corresponding four weeks of 1899.

**SWINE FEVER.**—During the last four weeks the outbreaks reported number 236, as against 207 outbreaks in the corresponding period of last year.

No case of Rabies has been reported during the current year, and no case of Foot-and-mouth disease since the third week of May last.

### **Stock Prizes.**

Mr. SANDAY (Chairman) reported that various matters arising out of the York Meeting had been considered, and instructions given to the Secretary thereon. The Committee had considered the recommendations of the sub-committee which was appointed at the meeting of the Council on May 1 to prepare a draft schedule of prizes to be offered in connection with the Cardiff Meeting of 1901, and would report further thereon. In accordance with the terms of the resolution passed at the meeting of the Council on February 7, 1900, "That, after the York Meeting, the competition in the classes for females three years old and upwards shall be limited to cows in-milk," the classes of cattle which were formerly open to cows or heifers in-milk or in-calf would now be limited to animals which were in-milk at the time of the Cardiff Show.

The Committee recommended that in future the Stock Prizes Committee be empowered to accept prizes from Breed Societies direct, in augmentation of those provided by the Society, instead of, as heretofore, receiving such prizes only through the local committee.

### **Implement.**

Mr. FRANKISH (Chairman) reported that the Committee had considered and given instructions as to various questions which had arisen in connection with the Society's recent York Meeting. They had also considered the regulations for the trials of ice-making plant at Cardiff, and they recommended that they should be amended to read as follows:

#### *Class III.—Ice-making Plant.*

1. The trials of the machines entered in Class III. will be held in the Cardiff Show-yard during the week preceding the Show. Due notice of the exact date of the trials will be given.

2. The Society will provide the usual shedding, 20 feet square, for each exhibit. In this shedding the trials will take place, and the plant will remain during the Show, when demonstrations of working will be made at times to be regulated by the Stewards.

3. Competitors must send a complete specification of their plant, with a general arrangement drawing showing the space occupied.

4. Competitors must provide their own insulated chamber, with everything necessary for working the apparatus. The Society will lay on a supply of water for cooling purposes.

5. The power taken will be duly tested, and the efficiency of the machine will be measured by the "thermal units" expended in the cooling of water.

6. In each case the amount and temperature of the cooling water will be carefully measured.

7. The condition of the air as regards moisture in the insulated chamber will be duly noted.

8. The points to which the special attention of the judges and engineers will be directed are:—

- (1) Power taken compared with the output.
- (2) Quantity of water used in condenser.
- (3) Attendance.
- (4) Nature of chemicals used and cost of same.
- (5) Condition of atmosphere in insulated chamber.
- (6) In case of compressors, the capacity of the compressor with regard to the output.
- (7) Price.

The Committee recommended that the name of Mr. John Howard Howard be added to the Implement Committee.

Mr. FRANKISH added that the Implement Committee had decided at their last meeting on May 29 (before the York Show) to recommend that trials of wind engines should be held next year in connection with the Meeting of 1901. At their meeting held on the previous day (July 31) the Committee had considered and amended some draft regulations for the trials of windmills, which had been prepared by the Consulting Engineer, but did not settle the amount of the prizes to be offered. Since then, it had been represented to him on the Finance Committee that, as the Society was already pledged to two expensive trials (of oil engines and ice-making plant) at Cardiff, it was undesirable in the present state of the Society's finances to add further to the cost of the implement trials next year. Under these circumstances he did not propose to press for the giving of prizes for windmills in 1901.

Mr. RANSOME said that the question of abandoning the proposed trials of wind engines at Cardiff had not come before the Implement Committee. On the contrary, they had spent a good deal of time the day before in framing regulations for the conduct of the trials, and he did not think that they ought now to give them up.

Mr. SANDAY said that the regulations for the trials of oil-engines and ice-making plant had already been publicly issued. These trials would cost a great deal of money, and he thought they would be sufficient, and that the trials of windmills could wait.

Mr. MARSHALL supported the view of Mr. FRANKISH.

The report of the Implement Committee was then adopted, with the exception of the approval of the draft regulations for the trials of windmills.

### **Showyard Works.**

Sir JACOB WILSON (Chairman) reported that most of the shedding is

the York Showyard had been pulled down, and that the permanent plant had been sent to Cardiff. He also reported that the first four timber sales had taken place, and that fair prices had been realised. The two concluding sales would take place on Wednesday, August 8, and Thursday, August 9, respectively. Various matters of detail in connection with the York Meeting had been considered, and instructions had been given thereon.

#### **Selection.**

Sir JOHN THOROLD (Chairman) reported that the Secretary had presented a report as to his visit to Paris as the representative of the Society at the recent International Agricultural Congress; and the Committee recommended that letters of thanks be sent in the name of the Council to those who gave facilities to the Secretary during his visit. The Committee gave notice of their intention to move at the next meeting of the Council an alteration of the present Bye-law 8, so as to give power to the Council to elect honorary members up to a maximum of fifty, of whom not more than twenty-five should be British subjects.

#### **Education.**

Mr. CRUTCHLEY reported that the detailed arrangements for the examination for the National Diploma in Dairying at Reading in September were now complete. The Committee recommended that a meeting of the National Agricultural Examination Board be held in October, during the week of the Dairy Show, in order to settle the report on the English and Scottish examinations in dairying for 1900, and the

details of both examinations for the year 1901. Mr. Martin Sutton had presented a report as to the International Congress on Agricultural Education held at Paris from June 14 to 16 last, and the Committee recommended that the paper presented by Mr. Sutton to the Congress be printed as a note in the September number of the Journal. The Committee further recommended that letters be written to Monsieur Casimir-Périer, the President, and to Monsieur de Lagorsse, the Secretary of the Congress, expressing the Society's appreciation of the reception accorded to the Society's representative.

#### **Dairy.**

Mr. DUGDALE (Chairman) reported that the Committee had had under consideration suggestions arising out of the Society's late Meeting at York, and also the framing of the produce prize-sheet for the Cardiff Meeting of 1901. The various modifications proposed in connection with the prizes to be offered for produce at the Cardiff Show would be embodied in the draft prize-sheet, and would be further considered by the Committee at their next meeting.

#### **Miscellaneous.**

The date of the December General Meeting of Governors and Members was fixed to be held at the Society's house at 13 Hanover Square, on Thursday, December 13, 1900 (the Thursday of the Smithfield Show week), and the dates of the Council Meetings in 1901 were also settled.

Other business having been transacted, the Council adjourned over the autumn recess until Wednesday, November 7, 1900.

# Proceedings at General Meeting of Governors and Members,

HELD IN THE LARGE TENT IN THE SHOWYARD AT

## THE YORK MEETING.

TUESDAY, JUNE 19, 1900.

H.R.H. THE PRINCE OF WALES, K.G. (PRESIDENT), IN THE CHAIR.

*Trustees.*—H.R.H. The Duke of York, K.G., Sir Walter Gilbey, Bart., Sir John H. Thorold, Bart.

*Vice-Presidents.*—The Earl of Coventry, the Earl of Feversham, Lord Moreton, the Hon. Cecil T. Parker, Sir Jacob Wilson.

*Other Members of Council.*—Mr. Alfred Ashworth, Lord Brougham and Vaux, Lord Arthur Cecil, Mr. F. S. W. Cornwallis, M.P., Mr. Percy Crutchley, Lieut.-Col. J. F. Curtis-Hayward, Mr. Alfred Darby, Mr. S. P. Foster, Mr. W. Frankish, Mr. Hugh Gorringe, the Earl of Jersey, G.C.B., Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Lord Middleton, Mr. T. H. Miller, Mr. P. A. Muntz, M.P., Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. C. C. Rogers, Mr. Howard P. Ryland, Mr. Alfred J. Smith, Mr. E. W. Stanyforth, Mr. E. V. V. Wheeler, and Mr. J. C. Williams.

*Governors.*—Mr. Charles E. Ashworth, the Earl of Harewood, Captain Holford, C.I.E., the Right Hon. Walter H. Long, M.P., Colonel Henry Platt, C.B., the Earl of Portsmouth, and Sir Cuthbert Quilter, Bart., M.P.

*Honorary Members.*—Professor Sir George Brown, C.B., and Landrath von Eizdorf.

The Lord Mayor of York (Mr. Alderman Rymer), the Sheriff of

York (Mr. Arthur Jones), Mr. Alderman Border, Mr. Alderman Foster, Sir F. G. Milner, Bart., M.P., and others were also present on the platform, and there was a crowded attendance of the general body of Members in the tent.

### Vote of Thanks to the York Local Committee.

H.R.H. The PRESIDENT, having opened the proceedings, called upon the Earl of Coventry to move the first resolution.

The EARL OF COVENTRY then moved:—"That the best thanks of the Society are due and are hereby tendered to the York Local Committee for their exertions to promote the success of the Meeting." He said he had much pleasure in moving this resolution, because, as Chairman of the General York Committee, he had frequently met at Hanover Square those gentlemen who represented the Local Committee, and he could testify personally to the zealous attention they had given to all the business which had come before them. He thought they would all congratulate the Local Committee very heartily upon the success they had achieved, and give them a cordial vote of thanks for all the trouble they had taken.

Mr. FOSTER (Senior Steward of Stock) seconded the resolution, remarking that the same duty fell to his lot seventeen years ago, at the

York Meeting of 1883, when His Royal Highness the Prince of Wales conferred upon their then President the Duke of Richmond, what he believed his Grace regarded as one of the proudest of his titles, viz., that of the "Farmers' Friend."

H.R.H. the PRESIDENT then put the resolution, and it was carried unanimously.

Mr. Alderman BORDER, in acknowledging the resolution on behalf of the Local Committee, expressed their gratitude to those local noblemen and gentlemen interested in agriculture, as well as their own citizens generally, for the great measure of support which they had given. It was a great pleasure to the Local Committee and an ample reward to know that their small services were so thoroughly appreciated by the "Royal" Society.

#### Vote of Thanks to the Lord Mayor and Corporation of York.

H.R.H. the DUKE OF YORK, K.G., next moved a resolution of thanks to the Lord Mayor and Corporation of York for their cordial reception of the Society. He said: The resolution which has been put into my hands is one which will, I am sure, meet with your most cordial reception. The renown of the City of York for the courtesy and hospitality with which it received the strangers within its gates is proverbial, as I have the best of reasons for testifying. (Cheers.) In view of the title which I am proud to bear, it is a high gratification to me that York has maintained its traditional reputation on the present occasion. All classes of the community have vied in their efforts to make the third visit of the Royal Agricultural Society to their city a success in every sense of the word. They have greeted the Society with the most cordial welcome; they have attended the show in numbers which give promise of a highly satisfactory result; and I trust the citizens will retain as agreeable memories of the Royal Show of 1900 as the Society and its members will take away with them. (Cheers.) The Prince of Wales at present holds the record for financial results at a Royal Show. I

hold the record (as President of the Society at the second Manchester Meeting of 1897) for the number of visitors. (Laughter and cheers.) Both as a citizen of York and as a Trustee of the Society, it would gratify me, as I am sure it would everyone present, if the third York Show of 1900, with the Prince of Wales in the Chair for the fourth time, should beat both records. (Cheers.) The Society is particularly indebted to the present Lord Mayor for his untiring efforts to promote in every way the success of this Show, and I am sure it will be your wish that the grateful thanks of the Society should be tendered to him, as the official head of the City, for all that he and his colleagues of the City Council have done to promote the success of the Show. I propose, therefore, with the greatest pleasure — "That the best thanks of the Society are due, and are hereby tendered, to the Lord Mayor and Corporation of the City of York for their cordial reception of the Society." (Loud cheers.)

Mr. PERCY CRUTCHLEY (Honorary Director) seconded the resolution, which was carried unanimously.

The LORD MAYOR OF YORK (Mr. Alderman Rymer), in reply, said they appreciated very much the words which H.R.H. the Duke of York had used. The Corporation of York had only been actuated by one desire, which was that everything connected, not only with the Show, but with the Royal visits, should be a thorough success. H.R.H. the Duke of York had said that this was the third time the Royal Show had visited the old City of York. They were a little afraid, from what they had read, that the remark might be true—"the third and the last time." They would, however, be very glad—if the Society was going to have a permanent location—if the Society could see its way to make that permanent location the good old City of York. He was very glad that their efforts were so highly appreciated, and that the entry of visitors into the Showyard gave promise of a successful Show.

**Suggestions of Members.**

H.R.H. The PRESIDENT said there was a time-honoured custom at these General Meetings that he should ask a question; but he hoped that, perhaps, they would consider it as a matter of form. He thought it would be evident to them, that with so many present and with so much to do, any matter of a controversial character would be best avoided. He would put the question—"Has any Governor or Member any remark to make, or suggestion to offer, that may be referred to the Council for their consideration?"

**Vote of Thanks to the President.**

No member rising in reply,

The Right Hon. WALTER LONG, M.P., said that, by virtue of his position as Minister for Agriculture, he enjoyed the special advantage of moving the next resolution, which he was satisfied required but to be named to secure the unanimous and enthusiastic acceptance of everybody present. The resolution was: "That the grateful thanks of the Society be dutifully tendered to H.R.H. the Prince of Wales, K.G., for his services as President during the past year."

It was not a mere matter of form to say that the value to their societies and great public institutions of the personal and individual attention of the members of the Royal Family could not be described in words or measured by anybody who attempted the task. Not only did H.R.H. the Prince of Wales and the other members of the Royal Family take an active interest in their public gatherings, but they identified themselves with the daily work of which this was but the annual demonstration. He was sure that it must be uppermost in all their minds at that moment that H.R.H. the Prince of Wales had passed through a by no means ordinary year. It had been extraordinary alike in its personal incidents and in its remarkable personal success. They prayed with all their hearts and souls that they might never see again the one personal incident which they all so deeply deplored at the time, and from which they all thanked God that His Royal

Highness had escaped unharmed. (Cheers.) He did not know that they could reasonably hope that His Royal Highness would again see so remarkable a success as that which he achieved in winning two of their greatest races, and in winning the second race with the own brother of the famous horse that had previously won it; but, at any rate, they hoped that, whether on the race course, where His Royal Highness was deservedly the most popular of those who attended, or on the Show-field, or in any other arena which His Royal Highness might think fit to enter as a competitor—many and many another trophy might be won by him, knowing as they knew that they would be fairly won amidst the acclamations of the whole of the people of this country.

He was confident in moving this resolution that it commended itself to them because of their feelings of attachment to His Royal Highness, because they knew that he did with his whole heart and soul whatever he undertook, and that he did it well; because they knew that in His Royal Highness they had as President one who worked with them—not merely by giving them the distinction of his great name, but also by giving them the inestimable advantage of his personal attention to the interests of the societies and institutions with which he was connected. He begged to propose the resolution, which he was sure would be received with universal acclamation. (Load cheers.)

Mr. JOHN TREADWELL, as an old member and exhibitor of the Society, and as an old farmer, had very great pleasure in seconding the vote of thanks to the "Prince of Farmers" (Laughter and cheers.)

The Secretary then put the resolution, which was carried by acclamation amidst great cheering.

H.R.H. The PRINCE OF WALES, whose rising was the signal for a further outburst of cheering, replied as follows:—I am grateful to my right honourable friend, Mr. Walter Long, and to my old friend, Mr. Treadwell, for the very kind terms in which they

have referred to my services as President of the Society during the past year, as well as to the members present for the cordial manner in which they have adopted the resolution. As you all know, I have taken for a good many years the greatest possible interest in the welfare of the Royal Agricultural Society, of which I have now been a member for the long period of thirty-six years. (Cheers.)

My son, the Duke of York, has alluded to my having four times served the office of President. The first time I was President is now thirty-one years ago, when the show was held in the Royal County of Lancaster—at Manchester in 1869. I have since been President at Kilburn in 1879, and at Norwich in 1886, besides being Acting-President when our fiftieth exhibition was held at Windsor in 1889 under the Presidency of Her Majesty the Queen. (Cheers.) And now I have the pleasure of acting as President when the show is being held in the capital city of the largest county in the United Kingdom; so I think I may claim to have an intimate knowledge of the Society and of its work.

York is, as you are aware, endeared to me by many memories, both sad and happy ones, and not the least by the fact that my lamented father, the Prince Consort, made here his first public appearance as an agriculturist. (Hear, hear.) At the first show held in this city, in 1848, he was in the showyard at six o'clock in the morning, in order to make a careful and uninterrupted inspection of all the exhibits. In the intervening half-century the showyard has increased to something like five times its extent, and I am, therefore, afraid that if I now attempted to repeat the duty performed by my father it would be necessary for me to get up very much

earlier in the morning than even he did. (Laughter.)

But thanks to the admirable arrangements of our Honorary Director, Mr. Crutchley, I have been able to get an excellent bird's-eye view of the present Show; and I shall hope to come again on Thursday, accompanied by the Princess of Wales, to complete my inspection. (Cheers.) The Society has held since its establishment six shows in Yorkshire—at York in 1848, at Leeds in 1861, at Hull in 1873, at York again in 1883, at Doncaster in 1891, and now for the third time at York in the concluding year of this wonderful century. Each of these six shows has in its way had special characteristics, showing progress in the art of agriculture and in the development of the Society, and I fervently hope that this present Meeting may have equally interesting and valuable results.

More than fifty years ago my father, in proposing "Success to the Royal Agricultural Society," at the first Meeting which it held in this ancient and historic city, made use of words which, as they were remarkably prophetic, and apply with even greater force at the present day, I feel I cannot do better than conclude by quoting. The Prince Consort said:

All I have seen at the Show exhibits a bright picture of the progress of British agriculture; and for much of that progress the country is, I firmly believe, indebted to this Society. Agriculture, which was once the main pursuit of this, like every other nation, holds even now, notwithstanding the development of commerce and of manufactures, a fundamental position in the realm. And although time has changed the position which was once held by the landed proprietor with his feudal

dependents, yet the country gentleman, the farmer, and the labourer form still one great and, I hope, united family—one united family, in which we gladly recognise the foundation of our social state. Science and mechanical improvements have changed the mere practice of cultivating the soil in these days into an industrial pursuit requiring capital, machinery, skill, and perseverance in the struggle of competition.

And now, I have only to thank my colleagues on the Council, and the various officers of the Society, as well as the members generally, for their valuable support during my year of office, and to say how gratefully the Royal Family and myself recognise and reciprocate the loyal attachment to the Throne which has always characterised the agriculturists of England. (Prolonged cheers.)

#### **President for 1900-1901.**

The EARL OF FEVERSHAM then moved—"That Earl Cawdor do take the Chair as President after the conclusion of the present Meeting." He would first express the regret which he felt that, according to the rules of the Society, they had to change their President year by year, because he was sure they would all very much prefer that His Royal Highness should have continued as their President. But such was the rule of their Society, and he therefore had the honour to propose that resolution. No one had served that

Society better than his noble friend Lord Cawdor. Everyone who was acquainted with the work of their Society would acknowledge that he had taken the most active and able part as Chairman of the Chemical Committee, and in other ways in the work and progress of the Society. He held a very honoured name, and bore a high character and reputation wherever he went, for his ability, industry, and integrity. He (Lord Feversham) regretted that Lord Cawdor was absent that day; but he was engaged in many active pursuits. He knew that the resolution would meet with the acceptance of every member of the Society.

Sir FREDERICK MILNER, Bart., M.P., seconded the resolution, saying that he had known Lord Cawdor from his very earliest days, as at Eton he had served him as fag—(laughter)—when he had always found him a good master. He had taken some interest in his career since, and he believed that he was an excellent landlord. He had, therefore, great pleasure in seconding the resolution that Lord Cawdor should be their future President.

The resolution having been carried unanimously,

H.R.H. The PRESIDENT said he had only to thank the members present for having attended in such large numbers, and also to express his cordial thanks for the kind way in which they had received him that day, as well as his regret that his duties as President would cease when the Show was over.

The proceedings then terminated.

# YORK MEETING.

JUNE 16 TO 22, 1900.

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## PRESIDENT :

**H.R.H. THE PRINCE OF WALES, K.G.**

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## OFFICIALS :

### Honorary Director.

**PERCY CRUTCHLEY**, Sunninghill Lodge, Ascot.

### Stewards of Live Stock.

**S. P. FOSTER**, Killhow, Carlisle.

**J. P. TERRY**, Berry Field, Aylesbury, Bucks.

**FREDEBICK REYNARD**, Sunderlandwick, Driffeld, Yorks.

**J. C. WILLIAMS**, Caerhays Castle, St. Austell, Cornwall.

### Stewards of Implements.

**G. H. SANDAY**, Highfield, Uxbridge.

**HOWARD P. RYLAND**, Moxhull Park, Erdington, near Birmingham.

**J. MARSHALL DUGDALE**, Llwyn, Llanfyllin, *viâ* Oswestry.

### Steward of Dairying.

**E. VINCENT V. WHEELER**, Newnham Court, Tenbury, Worcestershire.

### Steward of Forage.

**E. W. STANYFORTH**, Kirk Hammerton Hall, York.

### Stewards of Finance.

**W. FRANKISH**, Limber, near Brocklesby, Lincolnshire.

**F. S. W. CORNWALLIS**, M.P., Linton Park, Maidstone, Kent.

### Secretary.

**Sir ERNEST CLARKE**, 13 Hanover Square, London, W.

### Assistant Director.

**J. E. COMPTON-BRACEBRIDGE.**

### Supt. of the Showyard.

**ROBERT S. BURGESS.**

## JUDGES OF IMPLEMENTS.

### General Purpose Horse-Power Cultivators.—Class I.

#### Self-Moving Steam Diggers.—Class II.

**WALTER BUTLER**, 2 Whitehall Court, London, S.W.

**Professor W. E. DALBY**, Technical College, Finsbury, London, E.C.

**C. W. LISTER KAYE**, Estate Office, Osberton, Worksop.

### Milking Machines.—Class III.

**BAYNTON HIPPISELEY**, Ston Easton Park, Bath.

**FRANCIS E. WALKER**, Escrick, York.

### Sheep-Shearing Machines.—Classes IV. and V.

**JAMES P. CASE**, Benham, Wighton, R.S.O.

**C. W. LISTER KAYE**, Estate Office, Osberton, Worksop.

### Miscellaneous Implements entered for Silver Medals.

**BAYNTON HIPPISELEY**, Ston Easton Park, Bath.

**THOMAS STIRTON**, Bawdsey Estate Office, Woodbridge, Suffolk.

**JUDGES OF STOCK, &c.***(As finally corrected.)***HORSES.****Hunters.—Classes 1, 3, 5-8.**

JOHN B. COOKSON, Askham Bryan, York.

JOHN WATSON, Bective, Ireland.

**Hunters and Hacks.—Classes 2, 4, 9-13.**

Col. ANTHONY MARSHALL, Anstead, Chathill, Northumberland.

E. P. RAWNSLEY, Girsby Manor, Lincoln.

**Cleveland Bays.—Classes 14-21.**

THOMAS PETCH, Barns Farm, Skelton-in-Cleveland, Yorks.

GEORGE C. WHITWELL, Eaglescliffe, R.S.O., co. Durham.

**Coach Horses.—Classes 22-29.**

HARTAS FOXTON, Escrick, York.

WILLIAM HARRISON, Easingwold, Yorks.

**Hackneys.—Classes 30-43.**

Sir GILBERT GREENALL, Bart., Walton Hall, Warrington.

JOHN WREGHITT, Easthorpe, Market Weighton, Yorks.

**Ponies, Harness Horses and Ponies.****Classes 44-47 & 58-60.**

Sir H. F. DE TRAFFORD, Bart., Hill Crest, Market Harborough.

JOHN M. MARTIN, 5 Drummond Place, Edinburgh.

**Shetland Ponies, Mountain and Moorland Ponies.—Classes 48-51.**

JOHN M. MARTIN, 5 Drummond Place, Edinburgh.

J. J. R. MEIKLEJOHN, Novar, Evanton, Ross-shire.

**Polo Ponies.—Classes 52-57.**

WALTER S. BUCKMASTER, Croft House, Stansted, Essex.

Rev. T. F. DALE, East India United Service Club, St. James's Sq., S.W.

**Shires, and Draught Horses in Harness.—Classes 61-67 & 80-85.**

H. R. HART, Cannock, Staffordshire.

Captain HEATON, Worsley, near Manchester.

**Clydesdales.—Classes 68-73.**ABRAM KERR, Old Graitney, Carlisle.  
JAMES MCALISTER, Meikle Kil-mory, Rothesay, N.B.**Suffolks.—Classes 74-79.**EDWARD H. PRESTON, Wood Farm, Worlingworth, Wickham Market.  
SAMUEL TOLLER, Woodbridge.**CATTLE.****Shorthorns.—Classes 86-92.**

GEORGE ASHBURNER, Low Hall, Kirkby-in-Furness, Lancs.

JOHN C. TOPPIN, Musgrave Hall, Skelton, Penrith.

**Herefords.—Classes 93-99.**

JOHN HILL, Marsh Brook House, Church Stretton, Salop.

F. W. SHUKER, Scorrier, Cornwall.

**Devons.—Classes 100-105.**

HERBERT FARTHING, Holway House, Taunton.

C. MENHINTCK, Lower Amble, Wadebridge.

**Sussex.—Classes 106-110.**

JOHN NOAKES, Furnace Farm, Lamberhurst.

HENRY RIGDEN, Wall Estate, Ashford, Kent.

**Longhorns.—Classes 111 & 112.**

A. S. BERRY, Pheasey Farm, Great Barr, Birmingham.

JOHN T. OXLEY, Stowe, Buckingham.

**Welsh.—Classes 113-117.**

O. H. FOULKES, Bodwyn, Llangefni, Anglesey.

WILLIAM JONES, Llyngwyn, Chwilog, R.S.O., Carnarvon.

**Red Polled.—Classes 118-122.**

A. D. BRUCE, Elvetham Estate Office, Winchfield, Hants.

J. STURLEY NUNN, Little Welnetham Hall, Bury St. Edmunds.

**Aberdeen Angus.—Classes 123-127.**

ROBERT BRUCE, Leinster House, Dublin.

GEORGE J. WALKER, Portlethen, Aberdeen.

**Galloways and Ayrshires.**

*Classes 128-182 & 139-142.*

SAMUEL CLARK, Netherthird, Castle Douglas, N.B.

ROBERT SHENNAN, Balig, Kirkcudbright, N.B.

**Highland.**—*Classes 183-188.*

J. R. CAMPBELL, Shinness-by-Lairg, Sutherland, N.B.

DUNCAN McDIARMID, Camusericht, Rannoch, N.B.

**Jerseys.**—*Classes 143-147.*

HERBERT PADWICK, The Manor House, West Thorney, Emsworth.

HUGH C. SMITH, Mount Clare, Roehampton, Surrey.

**Guernseys.**—*Classes 148-152.*

G. TITUS BARHAM, Sudbury Park Farm, Harrow.

H. J. GIBBS, Milford, Salisbury.

**Kerry and Dexter.**

*Classes 153-156.*

H. D. D. BETTERIDGE, Drayton House, Littlebury, Essex.

A. D. BRUCE, Elvetham Estate Office, Winchfield, Hants.

**Dairy Cows.**—*Class 157.*

J. STURLEY NUNN, Little Welnetham Hall, Bury St. Edmunds.

JOHN T. OXLEY, Stowe, Buckingham.

**SHEEP.**

**Leicesters.**—*Classes 158-162.*

T. H. HUTCHINSON, The Manor House, Catterick, Yorks.

BENJAMIN PAINTER, Cow Close Farm, Burley-on-the-Hill, Oakham.

**Cotswolds.**—*Classes 163-167.*

J. J. GODWIN, Troy, Somerton, Banbury, Oxon.

T. R. HULBERT, Powyke, Worcester.

**Lincolns.**

*Classes 168-173.*

ROBERT FISHER, Leconfield, Beverley Yorks.

WILLIAM HESSELTINE, Beaumont Cote, Barton-on-Humber

**Oxford Downs.**—*Classes 174-178.*

JAMES P. CASE, Binham Abbey, Wighton, R.S.O.

A. F. MILTON DRUCE, 16 Queen Street, Oxford.

**Shropshires (Rams).**

*Classes 179-182.*

JOSEPH BEACH, The Hattons, Wolverhampton.

A. S. BERRY, Pheasey Farm, Great Barr, Birmingham.

**Shropshires (Ewes).**

*Classes 183 & 184.*

THOMAS A. BUTTAR, Corston, Coupar Angus, N.B.

WILLIAM THOMAS, The Beam House, Montford Bridge, Salop.

**Southdowns.**—*Classes 185-189.*

EDWARD HOBGEN, Shripney, Bognor, Sussex.

D. F. SMITH, Steward's Office, Easton Park, Wickham Market, Suffolk.

**Hampshire Downs.**—*Classes 190-194.*

WILLIAM M. HARRIS, Long Sutton, Winchfield, Hants.

W. T. TWIDELL, Mays Farm, Crowmarsh, Wallingford, Berks.

**Suffolks.**—*Classes 195-199.*

CHARLES H. COBDY, Walton, Ipswich.

J. W. EAGLE, The Hall, Walton-on-Naze, Essex.

**Border Leicesters.**—*Classes 200-204.*

JOHN DAVISON, Ulgham Park, Morpeth.

JOSEPH LEE, Markle, Prestonkirk, East Lothian.

**Wensleydales.**—*Classes 205-209.*

B. J. HODGSON, Hallwith, Spennithorne, Leyburn, Yorks.

THOMAS JACKSON, Netherbeck, Carnforth.

**Kentish or Romney Marsh.**

*Classes 210 & 211.*

JOHN S. S. GODWIN, Haslewood, Tonbridge, Kent.

HENRY RIGDEN, Lyminge, Hythe, Kent.

**Devon Long-wools.**

*Classes 212 & 213.*

ROBERT FISHER, Leconfield, Beverley Yorks.

WILLIAM HESSELTINE, Beaumont Cote, Barton-on-Humber.

**Somerset and Dorset Horned.**

*Classes 214 & 215.*

HERBERT FARTHING, Holway House, Taunton.

G. H. PITFIELD, Eype, Bridport, Dorset.

**Cheviots.—Classes 216-218.**

**NORMAN REID**, Newkelsa, Strathcarton, Ross-shire.  
**H. THOMPSON**, Clough Brae, Otterburn.

**Black-faced Mountain.**

*Classes 219-221.*

**JAMES GREENSHIELDS**, Westtown, Coalburn, N.B.  
**JAMES MOFFAT**, Gateside, Sanquhar, N.B.

**Herdwicks and Welsh.**

*Classes 222-225.*

**WILLIAM COCKBAIN**, Far Row, Threlkeld, Cumberland.  
**THOMAS MORRIS**, Pentref, Llanymynech, Oswestry.

**POULTRY.**

*Classes 248-245.*

**W. FORRESTER ADDIE**, Estate Office, Powis Castle, Welshpool.  
**D. BRAGG**, Aikton, Wigton, Cumberland.  
**EDWARD BROWN**, The Chestnuts, Theale, Berks.  
**ARTHUR C. MAJOR**, Park Farm, Langley, Bucks.  
**J. P. MARX**, Basford, Nottingham.

**PRODUCE.**

**Butter.—Classes 346-349.**

**Miss F. COWARD**, Colt Park, Ulverston, Lancs.  
**Miss E. A. ROBERTS**, Lleweni Hall, Denbigh.

**Cheese.—Classes 350-361.**

**JOHN BENSON**, Dale Road, Buxton, Derbyshire.  
**H. HEWITT**, 105 Victoria Street, Westminster, S.W.

**Cider and Perry.—Classes 362-365.**

**C. W. RADCLIFFE COOKE**, M.P., Hellens, Herefordshire.  
**CHARLES ROOTES**, Hereford.

**Hives and Honey.—Classes 366-389.**

**R. A. H. GRIMSHAW**, Hall Lane, Chapeltown Road, Leeds.  
**THOMAS D. SCHOFIELD**, Oakfield, Alderley Edge.

**HORSE-SHOERING COMPETITIONS.**

**JOHN MALCOLM**, F.R.C.V.S., Holliday Street Wharf, Birmingham.

**Professor PENBERTHY**, F.R.C.V.S., Royal Veterinary College, Camden Town, N.W.

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# AWARDS OF PRIZES AT YORK.

## ABBREVIATIONS.

I., First Prize. II., Second Prize. III., Third Prize. IV., Fourth Prize.  
R. N., Reserve Number. H. C., Highly Commended. Com., Commended.

**N.B.**—The responsibility for the accuracy of the description or pedigree, and for the eligibility to compete of the animals entered in the following classes, rests solely with the Exhibitors.

Unless otherwise stated, each Prize Animal in the Classes for Horses, Cattle, and Sheep was "bred by Exhibitor."

## HORSES.

### Thoroughbred Stallions.

*Winners of the Three Queen's Premiums of £150 each, awarded by the Royal Commission on Horse Breeding at the SPRING SHOW, held at THE ROYAL AGRICULTURAL HALL, LONDON, March 13-16, 1900, for Thoroughbred Stallions serving Mares during the Season of 1900 in District E—Yorkshire, and the Gold Medals, or £10 each, awarded by the York Local Committee.*

- A.** HENRY STRICKLAND CONSTABLE, Wassand, Hull, for *Cyclops*, brown, foaled 1890; *s.* Southampton, *d.* Brunette by Angelus, *g. d.* Brunetta by Codrington.
- B.** ALBERT OCTAVIUS HASLEWOOD, Fairfield Stud, Buxton, Derbyshire, for *Imprévu*, chestnut, foaled 1890; *s.* Archiduc, *d.* Iris by Mortimer, *g. d.* Isoline by Ethelbert; bred by the late C. J. Lefevre.
- C.** GILBERT LEIGH ABBOT, The Priory, Abbots Leigh, Somersetshire, for *Teboggan*, chestnut, foaled 1892; *s.* Marion, *d.* Tom Tom by Kettle-drum, *g. d.* Disguise by Thormanby.

### Hunters.

No. in Catalogue. **Class 1.**—*Hunter Mares (with Foals at foot), 15 stone and upwards.* [2 entries.]

- 2 I. (£20).—THOMAS SWALES, High Street, Yarm-on-Tees, for *Lady Grey*, grey, foaled 1889 [foal by Crooked Pin], bred by John Thompson, Stainton, Cleveland, Yorks; *s.* Ranelagh II.
- 1 II. (£10).—JOHN BAKER, The Grange, Bishop's Stortford, Herts, for *Stella* 2083, chestnut, foaled 1893 [foal by Swallowfield], bred by P. Shelly, Ballywater, Callan, Kilkenny; *s.* Herbertstown by The Lawyer.

**Class 2.**—*Hunter Mares (with Foals at foot), 12 to 15 stone.*  
[12 entries, 2 absent.]

- 13 I. (£20).—F. B. WILKINSON, Cavendish Lodge, Edwinstowe, Newark for *Lady Grosvenor* 779, bay, foaled 1889 [foal by Glory Smitten]; bred by R. T. Greaves, East Carlton, Uppingham, Rutland; *s.* Westminster.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 8 II. (£10).—R. CAVE-BROWNE-CAVE, Barton Court, Colwall, Malvern, for *The Geisha* 1646, grey, aged [foal by L'Abbé Morin], breeder unknown.  
 5 III. (£5).—JAMES S. DARBELL, West Ayton, Yorks, for *Diana* 996, chestnut, foaled 1886 [filly foal by *Roseus*], breeder unknown.  
 8 R. N.—LORD MIDDLETON, Birdsall House, York, for *Mignon*.

**Class 3.—Hunter Mares or Geldings, 15 stone and upwards, foaled in 1894 or 1895.<sup>1</sup> [21 entries, 11 absent.]**

- 16 I. (£30).—A. J. BROWN, Marr Grange, Doncaster, for *Wexford*, brown gelding, foaled 1895, bred by L. S. Carty, Holymount, Castlebridge, co. Wexford; s. *Torpedo*.  
 28 II. (£20).—G. D. FABER, M.P., 52 Sloane Street, London, S.W., for *Bay Prince*, bay, foaled 1894, bred by late Casey Connolly, Drogheda, co. Louth; s. *Brown Prince*, d. by *Revolver*.  
 32 III. (£10).—WM. JORDISON, Carlton House, Thirak, for *Mowbray Huntsman*, brown gelding, foaled 1895, bred by E. Jillings, Wyken Hall, Bardwell, Suffolk; s. *Ricotto*, g. d. *Potatoes* 1565.  
 29 IV. (£5).—JOHN FOXTON, Riccal House, Kirbymoorside, for *Muscoates*, bay gelding, foaled 1895; s. *Warpath*, d. *Candidate* by *Monarch*.  
 20 R. N. & Com.—CHARLES E. CLARK, North Ferriby, East Yorks, for *Baby*.

**Class 4.—Hunter Mares or Geldings, 12 to 15 stone, foaled in 1894 or 1895.<sup>1</sup> [32 entries, 9 absent.]**

- 61 I. (£30).—J. H. STOKES, Nether House, Great Bowden, Market Harborough, for *King Bronze*, chestnut gelding, foaled 1895, bred by W. Crasen, Killala, co. Mayo; s. *North Mayo*, d. by *Lothario*.  
 67 II. (£30).—F. B. WILKINSON, Cavendish Lodge, Edwinstowe, Newark, for *Cavendish*, brown gelding, foaled 1894, breeder unknown.  
 60 III. (£10).—J. H. STOKES, Great Bowden, for *Briton*, bay gelding, foaled 1894, bred by Mr. Bradshaw, Eggleton, Oakham; s. *Belville*.  
 64 IV. (£5).—T. & H. WARD, Pinchinthorpe, Gt. Ayton, Yorks, for *The Knight*, bay gelding, foaled 1895, bred by E. Jillings, Wyken Hall, Bardwell, Suffolk; s. *Ricotto*, d. *Potatoes* 1565.  
 52 R. N. & H. C.—EDWARD HOYLE, Moorlands, Bacup, Lancs, for *Countess*.  
 57 Com.—RICHARDSON & RICKABY.

**Class 5.—Hunter Geldings, foaled in 1896.<sup>1</sup> [22 entries, 3 absent.]**

- 77 I (£25).—EDWARD HODGSON, The Hollows, Bridlington, Yorks., for *Volunteer*, brown gelding, bred by W. A. Ritson, jun., Lanchester, Durham; s. *Millfield*, d. by *Haphazard*.  
 76 II. (£15).—EDWARD HODGSON, Bridlington, for *Shannon View*, chestnut, bred by Michael O'Brien, Shannon View House, Limerick; s. *Sir Hugh*, d. by *Rhidorrook*.  
 75 III. (£10).—W. HARDWICK, Keld Knowle, Wreton, Pickering, for *Yorkshireman*, bay; s. *Touchwood*, d. by *King Otto*.  
 80 IV. (£5).—JOSEPH HUGILL, Sockburn, Darlington, for *Sockburn*, chestnut, bred by Col. Godman, Gt. Smeaton, Northallerton; s. *Boykin*, d. by *Argyle*.  
 86 R. N. & H. C.—RICHARDSON & RICKABY, Westfield, Acomb, Yorks.  
 H. C.—E. & A. BAXTER, for No. 68, *Aristotle*; J. BENSON & SON, for No. 69, *FitzSimmon*; A. J. BROWN, for No. 70; W. B. BROWN, for No. 71, *Sly Fox*; TOM DAWSON, for No. 72, *Goldfinch*; SIR H. F. DE TRAFFORD, Bt., for No. 73, *Guinea*; E. HODGSON, for No. 78, *Waterproof*; T. D. JOHN, for

<sup>1</sup> Prizes given by the York Local Committee

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

No. 81, *Donerale*, and No. 82, *Huntsman*; G. MARTON, for No. 83, *First Flight*; LORD MIDDLETON, for No. 84; RICHARDSON & RICKABY, for Nos. 85 and 86; C. SCHWABE, for No. 87, *Liscomb*; T. & H. WARD, for No. 89, *Lord Clare*.

**Class 6.—*Hunter Mares, foaled in 1896.*<sup>1</sup> [10 entries, 1 absent.]**

- 98 I. (£25.)—J. H. STOKES, Nether House, Great Bowden, Market Harborough, for brown mare, bred by A. B. Long, Hurts Hall, Saxmundham, Suffolk; s. Hanover Jack.
- 97 II. (£15.)—J. H. STOKES, Great Bowden, for *Miss Nap*, chestnut, bred by T. Horsford, Warmington, Oundle; s. King of Trumps.
- 96 III. (£10.)—RICHARDSON & RICKABY, Westfield, Acomb, Yorks, for *Lady Roberts*, bay, breeder unknown.
- 94 IV. (£5.)—J. S. PYKE-NOTT, Porlock, Somerset, for *Moorhen* (late *Moorbird*) 2000, brown, bred by J. Weir, Cross Hill, Blanchland, Northumberland; s. The Moor.
- 91 R. N. & H. C.—EDWARD HOYLE, Moorlands, Bacup, for *Lady Gordon*.

**Class 7.—*Hunter Geldings, foaled in 1897.*<sup>1</sup> [17 entries, 3 absent.]**

- 103 I. (£15.)—A. J. BROWN, Marr Grange, Doncaster, for *Richard I.*, chestnut, bred by T. Keating, Ballynard, Fethard, co. Tipperary; s. Dick Turpin, d. *Peggy by Suspect*.
- 113 II. (£10.)—J. S. PYKE-NOTT, Porlock, Somerset, for *Union Jack*, chestnut, bred by Lord Kensington, St. Brides, Little Haven, Wales; s. Glory Smitten, d. *by Free Trade*.
- 115 III. (£5.)—T. & H. WARD, Pinchinthorpe, Great Ayton, Yorks, for *Blacktherne*, black, bred by Mr. Fox, Dundalk, Ireland; s. *Slavegullion*.
- 105 R. N. & H. C.—J. S. DARRELL, West Ayton, Yorks, for *Silverdale*.
- 114 H. C.—BERNARD WALL, for *Masterman*.

**Class 8.—*Hunter Fillies, foaled in 1897.* [7 entries, 1 absent.]**

- 121 I. (£15, & R. N. for *Champion*.)—LORD MIDDLETON, Birdsall House, York, for *Hollyhock* 1906; s. Gordon, d. *Hollow Back* 1048 *by Spectre* Lord.
- 123 II. (£10.)—FRANCIS SAMUELSON, Breckenbrough Hall, Thirsk, for *Mullingar Junior*, chestnut; s. Trundle Hill, d. *Mullingar* 1144.
- 120 III. (£5.)—F. WILSON HORSFALL, Potto Grange, Northallerton, for *Queen Mary* 2042, bay, bred by Arthur Harrowing, Carr View Hall, Sleights, Whitby; s. *Khartoum*, d. *Revival by Sacrados*.
- 119 R. N.—J. S. DARRELL, West Ayton, Yorks.

**Class 9.—*Hunter Geldings, foaled in 1898.*<sup>1</sup>**

[8 entries, 2 absent.]

- 127 I. (£15.)—JOHN LETT, Cleveland Stud Farm, Billington, Yorks, for *Eclat*, chestnut, bred by R. Duggleby, Sherburn, Yorks; s. *Dermont*, d. *by Conductor*.
- 125 II. (£10.)—C. F. HILLYARD, Malton Road, York, for *Huntington*, chestnut; s. *Highflyer*, d. *by Duc de Beaufort*.
- 131 III. (£5.)—T. & H. WARD, Pinchinthorpe, Great Ayton, Yorks, for *Blackbird*, black, bred by Mr. Fox, Dundalk, Ireland; s. *Slavegullion*.
- 128 R. N. & Com.—LORP MIDDLETON, Birdsall House, York.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Gold Medal, value £10 10s. given by the Hunters' Improvement Society for the best Hunter Filly exhibited in Classes 8, 10, and 12.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 10.—*Hunter Fillies, foaled in 1898.* [13 entries, 2 absent.]**

- 138 I. (£15, & Champion.<sup>1</sup>)—R. E. DIXON, Benningholme Hall, Skirlaugh, Hull, for *Lady Meta* 1943, chestnut; s. Otterburn, d. *Lady Dora* 1075 by Gallant.  
 141 II. (£10.)—C. KELWAY-BAMBER, Springfield Lodge, Chelmsford, for *Homely Lass* 1907, chestnut; s. Homely, d. *Sweetheart* 1641 by Napsbury.  
 136 III. (£5.)—EDWARD DALGLISH, Toft House, Dunchurch, Rugby, for *Fleur-de-Lys*, bay, bred by R. N. Byass, Wyck Hill, Stow-on-the-Wold, Glos.; s. Herald, d. *Tormonite* 473 by The Lawyer.  
 134 B. N. & H. C.—G. A. BROWN, Middleton Wolds, Beverley, for *Lavender*.  
 142 Com.—LORD MIDDLETON, for *Busybody*.

**Class 11.—*Hunter Colts or Geldings, foaled in 1899.*<sup>2</sup>  
 [5 entries, 1 absent.]**

- 147 I. (£15.)—GEORGE MARTON, Muscoates, Kirby Moorside, for *Plunger*, chestnut colt; s. Spendthrift, d. *Dauntless* 992 by Conductor.  
 145 II. (£10.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts, for *Marchwind*, chestnut colt, bred by F. W. Barling, New House, Ross, Herefordshire; s. *Whisperer*, d. *Stella* 2083 by Herbertstown.  
 146 B. N. & H. C.—EDWARD HOYLE, Moorlands, Bacup, Lancs, for *Rosebery*.

**Class 12.—*Hunter Fillies, foaled in 1899.*  
 [5 entries, none absent.]**

- 152 I. (£10.)—LORD MIDDLETON, Birdsall House, York, for chestnut; s. Gordon, d. *Miss Sykes* by Morocco.  
 151 II. (£5.)—JONATHAN R. HAGUE, 7 Charlton Street, Stockton-on-Tees, for *Lady Ruby*, chestnut; s. Knight of Ruby, d. *Polly Blue* by Blue Back.  
 154 B. N.—EDWIN WARDLE, Linton Spring, Wetherby, for *Lorna*.

## Hacks.

**Class 13.—*Hack Mares or Geldings, for riding purposes, not exceeding 15 hands, foaled in 1894, 1895, or 1896, to be ridden in the Ring, and to be judged by the Hunter Judges.*<sup>3</sup> [3 entries, 1 absent.]**

- 155 I. (£15.)—F. J. & H. GRAINGER, Thornholme, Burton Agnes, Driffield, for *Chance*, bay mare, foaled in 1896; s. *Oliver Twist* or *Riversdale*, d. *Gazelle* by King of the Forest.  
 157 II. (£10.)—H. TRACKERAY SCHWABE, Parvey, Macclesfield, for chestnut gelding, foaled 1896; s. *Red Eagle*, d. *Mystery*.

## Cleveland Bays.

**Class 14.—*Cleveland Bay Stallions, foaled in 1897.*<sup>2</sup>  
 [4 entries, 1 absent.]**

- 161 I. (£15, & Champion<sup>2</sup>)—H. C. STEPHENS, M.P., Cholderton, Salisbury, for *Wellington*; s. Marston 1080, d. *Greta* 700 by Tertius 926.

<sup>1</sup> Champion Gold Medal, value £10 10s., given by the Hunters' Improvement Society for the best Hunter Filly exhibited in Classes 8, 10, and 12.

<sup>2</sup> Prizes given by the York Local Committee.

<sup>3</sup> Champion Prize of £10, given by the Cleveland Bay Horse Society for the best Cleveland Bay Stallion exhibited in Classes 14 and 15.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

158 II. (£10).—F. P. BAKER, Ingmanthorpe Grange, Wetherby, for Ingmanthorpe Mikado 1469; s. Ingmanthorpe Duke 1389, d. Empress II. 162 by Newton 216.

159 B. N. & H. C.—GEORGE SCOBY, for Duke of Marlborough.

**Class 15.—Cleveland Bay Stallions, foaled in 1898.**

[9 entries, 1 absent.]

170 I. (£15, & B. N. for Champion<sup>1</sup>).—F. H. STERICKER, Westgate House, Pickering, for Potto Baron 1538, bred by A. Moscrop, Marske-by-the-Sea; s. The Marquis 1407, d. Flash 969 by Reform 653.

162 II. (£10).—BECKETT BROS., Deighton, Escrick, York, for Smylett Albert, 1559, bred by H. P. Pease, M.P., Undercliffe, Great Ayton, Yorks; s. King Albert 1075, d. Artifice by Luck's All 187.

166 III. (£5).—JOHN LETT, Cleveland Stud Farm, Rillington, Yorks, for Lyddite, bred by Rt. Hon. J. Lowther, M.P., Wilton Castle, Redcar; s. Hyllus 969, d. Fortuna 56.

165 B. N. & H. C.—F. WILSON HORSFALL, Northallerton, for Potto Lord.

**Class 16.—Cleveland Bay Mares (with Foals at foot).**

[6 entries, 1 absent.]

174 I. (£15, & B. N. for Champion<sup>2</sup>).—JOHN LETT, Cleveland Stud Farm, Rillington, Yorks, for Madam II. 977, foaled 1894, [foal by Lucky Hero 1492], bred by H. C. Stephens, M.P., Cholderton, Salisbury; s. Luck's All 189, d. Madam 70 by Fidius Dins 107.

176 II. (£10).—H. C. STEPHENS, M.P., Cholderton, Salisbury, for Miss Welcome 1075, foaled 1896 [foal by Lorenzo 1402]; s. Marston 1080, d. Festivity.

173 III. (£5).—F. WILSON HORSFALL, Potto Grange, Northallerton, for Coatham Queen 1028, foaled 1895 [foal by King Albert 1075], bred by Rt. Hon. J. Lowther, M.P., Wilton Castle, Redcar; s. Hyllus 969, d. Fortuna 56, by Fidius Dins 107.

175 B. N. & H. C.—GEORGE SCOBY, for Lady Ugthorpe.

**Class 17.—Cleveland Bay Geldings, foaled in 1897.<sup>3</sup> [2 entries.]**

178 I. (£15).—BERT KITCHING, Hungate, Pickering, for Cawthorne, bred by Mr. Smith, Carr House, Stokesley, Yorks; s. Shylock.

177 II. (£10).—THOMAS CUBBY, Morton Carr, Nunthorpe, Yorks, for Morton Prince 1474; s. Pitch and Toss, 1204, d. Ariadne 925 by Hyllus 969.

**Class 18.—Cleveland Bay Geldings, foaled in 1898.<sup>3</sup> [1 entry.]**

179 I. (£15).—BERT KITCHING, Hungate, Pickering, for Levity, bred by Mr. Hebron, Hornby, Yorks; s. King of the Dales.

**Class 19.—Cleveland Bay Fillies, foaled in 1897 or 1898.<sup>3</sup>**

[8 entries, none absent.]

184 I. (£15, & Champion<sup>2</sup>).—H. C. STEPHENS, M.P., Cholderton, Salisbury, for Cholderton Darling 1106, foaled 1898; s. Luck's All 189, d. Depper 42, by Barnaby 21.

183 II. (£10).—GEORGE SCOBY, Beadlam Grange, Nawton, Yorks, for Beadlam Girl, foaled 1898, bred by John Robinson, Priory Farm, Grosmont, Whitby; s. Prince George, 367, d. Girl of the Period by Sportsman 299.

<sup>1</sup> Champion Prize of £10, given by the Cleveland Bay Horse Society for the best Cleveland Bay Stallion exhibited in Classes 14 and 15.

<sup>2</sup> Champion Prize of £10 given by the Cleveland Bay Horse Society for the best Cleveland Bay Mare or Filly exhibited in Classes 16, 19, and 21.

<sup>3</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 186 III. (£5.)—H. C. STEPHENS, M.P., Cholderton, for *Empress 1043*, foaled 1897; *s. Luck's All 189*, *d. Depper 42* by *Barnaby 21*.  
 185 B. N. & H. C.—H. C. STEPHENS, M.P., for *Diamond*.  
 182 Com.—G. T. PETCH, for *Lady Flash*.

**Class 20.—*Cleveland Bay Colts or Geldings, foaled in 1899.*<sup>1</sup>**

[8 entries, 2 absent.]

- 189 I. (£15.)—F. WILSON HORNFALL, Potto Grange, Northallerton, for *Potts Duke*, colt, bred by John Stango, Lythe, Whitby; *s. Pitch and Toss 1204*, *d. by Prince George 235*.  
 195 II. (£10.)—F. H. STERICKER, Westgate House, Pickering, for *Salford 1553*, colt, bred by John Welford, Loftus Grange, Yorks; *s. Pitch and Toss 1204*, *d. Miss Hillingdon 728* by *Lord Hillingdon 986*.  
 190 III. (£5.)—JOHN LETT, Cleveland Stud Farm, Billington, Yorks, for *Lord Redcar*, colt, bred by Rt. Hon. J. Lowther, M.P., Wilton Castle, Redcar; *s. The Marquis 1407*, *d. The Prude 749* by *Reform 653*.  
 194 B. N. & H. C.—H. C. STEPHENS, M.P., for *Cholderton Tertius*.

**Class 21.—*Cleveland Bay Fillies, foaled in 1899.*<sup>1</sup>**

[4 entries, none absent.]

- 199 I. (£15.)—H. C. STEPHENS, M.P., Cholderton, Salisbury, for *Cholderton Marjorie 1109*; *s. Lorenzo 1402*, *d. Madam 70* by *Fidius Dins 107*.  
 196 II. (£10.)—The EXORS. OF THE LATE H. E. M. DAVIES, Cavenham Park, Soham, Suffolk, for *Broomgrove Dolly 1101*, bred by H. Ellis, Howard Lodge, Filsham Road, St. Leonard's-on-Sea; *s. Broomgrove Pride 1364*, *d. Broomgrove Aggie 1024* by *Leveret 1351*.  
 198 B. N. & H. C.—H. C. STEPHENS, M.P., Cholderton, for *Cholderton Daisy*.

## Coach Horses.

**Class 22.—*Coaching Stallions, foaled in 1897.*<sup>1</sup>**

[9 entries, none absent.]

- 208 I. (£15, & Champion<sup>2</sup>)—JOHN WHITE, The Grange, Appleton Roebuck, Bolton Percy, Yorks, for *Master John 2229*, bay; *s. Onyx 2107*, *d. Digamma 405* by *Captain Sykes 1002*.  
 200 II. (£10.)—GEORGE BURTON, Thorpe Willoughby, Selby, Yorks, for *Count Risby 2256*, bay, bred by John Parker, Cottingham, York; *s. Lord Risby 1402*, *d. Rose 142* by *Palestine 613*.  
 203 III. (£5.)—EDWARD GOODRICK, Stillingfleet, York, for *Stillingfleet 2235*, bay; *s. Prince Victor 376*, *d. by Cawston 79*.  
 202 B. N. & H. C.—G. F. CUMBERLAND, Selby, for *Count Willoughby*.  
 201 Com.—GEORGE BURTON, for *Yorkshire Gentleman*.

**Class 23.—*Coaching Stallions, foaled in 1898.* [7 entries, 1 absent.]**

- 210 I. (£15 & B. N. for Champion<sup>2</sup>)—EDWARD CONNELL, Heslington, York, for *Albert*, bay, bred by George Elders, Toft House Farm, Aislaby, Whitby; *s. King Albert 1075*, *d. Lady Aislaby 971* by *Pitch and Toss 1204*.  
 211 II. (£10.)—JOHN LETT, Cleveland Stud Farm, Billington, Yorks, for *Speciality*, bay; *s. Merry Heart 1299*, *d. Beatrice 932* by *Billington Venture 1114*.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Prize of £10 given by the Yorkshire Coach Horse Society for the best Coach Horse Stallion exhibited in Classes 22 and 23.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 215 III. (£5.)—F. H. STERICKER, Westgate House, Pickering, for Glentworth 2286, bay, bred by Wm. Cooper, Otterington, Northallerton; s. King Albert, d. Princess Beatrice by Luck's All 1114.
- 209 B. N. & H. C.—BECKETT BROS., Deighton, Escrick, York, for Battenburg.

**Class 24.—Coaching Mares (with Foals at foot).**

[5 entries, none absent.]

- 219 I. (£15, & Champion.)—JOHN SCAIFE, Scrayingham, Stamford Bridge, Yorks, for Queen Anne 837, bay, foaled 1896 [foal by Mischief 2173]; s. Prince Victor 376, d. Scrayingham Lilly 510 by Yorkshire Champion.
- 220 II. (£10.)—GEORGE SCOBY, Beadlam Grange, Nawton, Yorks, for Princess Georgie 802, foaled 1894 [filly foal by King George 1398], bred by W. H. S. Pyman, Moss Brow, Whitby; s. Prince George 367, d. by Newton.
- 217 B. N. & H. C.—J. W. LETT, Welburn, York, for Lady Harum.

**Class 25.—Coaching Geldings, foaled in 1897.<sup>1</sup>**

[14 entries, 1 absent.]

- 225 I. (£15.)—WM. BECKETT, Manor House, Copmanthorpe, York, for Courtier, bay; s. Baronet, d. Merit by Premier.
- 227 II. (£10.)—EDWARD CONNELL, Heslington, York, for Primrose General, bay.
- 232 III. (£5.)—SILVESTER LEAF, Glade Farm, Escrick, York, for Elegance, bay, bred by Mr. Glew, Harthorpe, Selby; s. Stour-on-Avon, d. by Wonderful Lad.
- 226 B. N. & H. C.—EDWARD CONNELL, Heslington, for Primrose Duke. Com.—W. BECKETT, for No. 224, Baron; E. CONNELL, for No. 228, Primrose Justice; S. FOXTON, for No. 229, Speculation.

**Class 26.—Coaching Geldings, foaled in 1898.<sup>2</sup>**

[5 entries, 1 absent.]

- 236 I. (£15.)—EDWARD CONNELL, Heslington, York, for Primrose Hero, bay, bred by George Mead, Whitby; s. Barnaby, d. by County King.
- 238 II. (£10.)—STRICKLAND FOXTON, Escrick, York, for Lord Roberts, bay, bred by J. Palframan, Haddlesey, Selby; s. Connaught.
- 235 B. N. & H. C.—F. H. CARR, Catton Grange, York, for Lord Roberts.

**Class 27.—Coaching Fillies, foaled in 1897 or 1898.<sup>2</sup>**

[8 entries, none absent.]

- 247 I. (£15, & B. N. for Champion.)—JOHN WHITE, The Grange, Appleton Roebuck, Bolton Percy, Yorks, for Topsy 843, bay, foaled 1897; s. Lord Risby 1402, d. Ainsty Queen 367 by Favourite 581.
- 241 II. (£10.)—E. & R. DUTTON, Woodhouse Grange, Poppleton, Yorks, for Forget-me-not 861, bay, foaled 1898; s. Lord Risby 1402, d. Georgiana I. 424 by Prince George 367.
- 243 III. (£5.)—SILVESTER LEAF, Glade Farm, Escrick, York, for Florisel 877, bay, foaled 1898; s. Beacon Prince 2227, d. Frolicsome 423 by Fidius Dius 1592.
- 245 B. N. & H. C.—JOHN LETT, Rillington, Yorks, for Delight.

<sup>1</sup> Champion Prize of £10 given by the Yorkshire Coach Horse Society for the best Coach Horse Mare or Filly exhibited in Classes 24, 27, and 29.

<sup>2</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 28.—Coaching Colts or Geldings, foaled in 1899.<sup>1</sup>**

[10 entries, 1 absent.]

- 253 I. (£15.)—SILVESTER LEAF, Glade Farm, Escrick, York, for *Royal Beacon*, bay colt; s. Beacon Prince 2227, d. Frolicsome 423 by Fidius Dius 1592.  
 252 II. (£10.)—THOMAS KNAGGS, Tofts Farm, Marske-by-the-Sea, Yorks, for *Up-to-date*, bay colt; s. Prince George 367, d. by Favourite, 581.  
 256 III. (£5.)—CHARLES J. ROOK, Habton, Malton, Yorks, for *Bookbarnugh Admiral*, bay colt; s. Noble Prince 2211, d. Lady Stansfield by Lord Stansfield.  
 248 R. N. & H. C.—BECKETT BROS., Deighton, Escrick, York, for *Majestic*.  
 251 Com.—BERT KITCHING, for Lyddite.

**Class 29.—Coaching Fillies, foaled in 1899.<sup>1</sup>**

[5 entries, 1 absent.]

- 261 I. (£15.)—J. W. LETT, Mount Pleasant, Welburn, York, for *Lively*, bay; s. Lucky Hero 1492, d. Cherry Favourite 792 by First Favourite 2038.  
 262 II. (£10.)—ANDREW MOSCROP, Sparrow Park Farm, Marske-by-the-Sea, Yorks, for *Marske Bonny* 1138, bay; s. Hyllus 969, d. Dashaway 612 by Fidius Dius 107.  
 259 R. N. & H. C.—ROBERT BRUNTON, High Farm, Marton, Yorks.

## Hackneys.

**Class 30.—Hackney Stallions, foaled in 1897, 15 hands and upwards. [20 entries, 2 absent.]**

- 281 I. (£15, & R. N. for Champion.<sup>2</sup>)—GEORGE WILSON, Cedar House Farm, Garton, Driffield, for *Rodasor* 6877, chestnut, bred by Exhibitor and E. T. Barber, Haverfield, Patrington, Hull; s. Rosador 4964, d. Garton Primrose 7905 by Garton Denmark 3618.  
 282 II. (£10.)—FREDERICK WRENCH, Killacoon, Ballybrack, co. Dublin, for *Silver Squire* 6901, chestnut; s. Clovelly 4690, d. Silver Threads 7411 by Harvester 1799.  
 264 III. (£5.)—COCKAYNE BROS., Hackney Stud Farm, Sheffield Lane Paddocks, Sheffield, for *Paddock Polonius* 7208, chestnut, bred by J. H. Bryars, Blonk Street, Sheffield; s. Polonius 4931, d. Pasture Duchess 5969, by Connaught 1453.  
 270 R. N. & H. C.—H. LIDDELL-GRAINGER, Ayton Castle, N.B., for *Nugget*.  
 263 H. C.—J. N. ANTHONY, for *Sedgeford Duke*.

**Class 31.—Hackney Stallions, foaled in 1897, above 14 hands and under 15 hands.<sup>1</sup> [3 entries, 1 absent.]**

- 284 I. (£15.)—CRAVEN FORT, Steeton, Keighley, Yorks, for *Steeton Performer* 6910, chestnut; s. Garton Duke of Connaught 3009, d. Village Belle 8553 by Sensation 6th 3265.

**Class 32.—Hackney Stallions, foaled in 1898.**

[17 entries, 4 absent.]

- 293 I. (£15, & Champion.<sup>2</sup>)—SIR WALTER GILBENY, BT., Elsenham Hall, Essex, for *Bonny Danegelt* 6990, chestnut; s. Royal Danegelt 5785, d. Lady Dorothy 185 by Denmark 177.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Gold Medal given by the Hackney Horse Society for the best Hackney Stallion exhibited in Classes 30-32.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 302 II. (£10.)—J. & H. P. WEBSTER, Stud Farm, Brompton, R.S.O., Yorks, for Brompton Merrylegs, chestnut, bred by J. M. Mitchelsen, The Hall, Pickering; s. Langton 6078, d. Buckthorpe Belle by Anconens 3rd (late Goman) 2093.
- 291 III. (£5.)—C. E. GALBRAITH, Terregles, Dumfries, N.B., for Athara 6964, chestnut; s. Garton Duke of Connaught 3009, d. Lola 4248, by Cadet 1251.
- 287 B. N. & H. C.—AUSTIN C. CARR, for Towthorpe Performer.  
Com.—G. M. GALE, for No. 292, Atwick Junior; A. A. HALEY, for No. 294, Merry Pioneer.

**Class 33.—Hackney Stallions, foaled in 1899.**

[6 entries, 3 absent.]

- 803 I. (£15.)—S. B. CARNLEY, Norbury House Stud, Alford, Lincs., for Norbury Lightning, bay; s. Polonius 4931, d. Vanity 2490 by Candidate 920.
- 804 II. (£10.)—WILLIAM HURST, Sandal, Wakefield, for Meres, chestnut; s. Garton Duke of Connaught 3009, d. Sibyl 7403 by Rokeby 2249.
- 306 B. N. & Com.—A. SIMPSON, Allerthorpe, Pocklington, for Allerthorpe.

**Class 34.—Hackney Mares (with Foals at foot), 15 hands and upwards.** [9 entries, 4 absent.]

- 315 I. (£15, & Champion.<sup>1</sup>)—HARRY LIVESY, Rotherfield, Sussex, for Orange Blossom 5957, chestnut, foaled 1891 [foal by McKinley 6475], bred by Wm. Baxter, Burton Pidsea, Hull; s. Connaught 1453, d. Orange Girl 2nd 8347 by General Gordon 2084.
- 316 II. (£10.)—HARRY LIVESY, Rotherfield, for Surprise 3299, chestnut, foaled 1889 [foal by McKinley 6475], bred by Walter Waterhouse, Starborough Stud Farm, Edenbridge, Kent; s. Ritualist 1542, d. Brunette 49 by Lord Derby 2nd 417.
- 313 III. (£5.)—J. T. IRELAND, Molescroft Grange, Beverley, for Lady Connaught 12798, chestnut, foaled 1896 [foal by Revival 7236]; s. Garton Duke of Connaught 3009, d. Providence 9443 by Cotton Spinner 3520.
- 314 B. N.—E. J. JOHNSTONE, Rougham Hall, Bury St. Edmunds, for Alert.

**Class 35.—Hackney Mares (with Foals at foot), above 14 hands and under 15 hands.<sup>2</sup>** [5 entries, 1 absent.]

- 318 I. (£15.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts, for Isoline 9003, chestnut, foaled 1891 [foal by Wyngelt 6618], bred by Joseph Morton, Stow Bardolph, Downham, Norfolk; s. Anconens 2nd 1975, d. Minnie 2808 by Cadet 1251.
- 321 II. (£10.)—WILLIAM JOHNSON, Cowthorpe, Wetherby, Yorks, for Concord 3604, brown, foaled 1889 [foal by Ganymede 2076], bred by C. H. Hart, Dunnington Lodge, York; s. Prince Alfred 1325, d. Crafty 1063 by Denmark 177.
- 322 B. N. & Com.—BENJ. OAKES, Hildenborough Stud, Tonbridge, for Celia.

**Class 36.—Hackney Geldings, foaled in 1897.<sup>3</sup>**

[6 entries, 1 absent.]

- 324 I. (£15.)—SIR WALTER GILBERT, Bt., Elsenham Hall, Essex, for Bright Spark 6669, bay; s. Royal Dane 5782, d. Jessy 163 by Confidence 158.

<sup>1</sup> Champion Gold Medal given by the Hackney Horse Society for the best Hackney Mare of July exhibited in Classes 34, 35, 37, 39, and 41.

<sup>2</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 325 II. (£10.)—CHRISTOPHER HARRISON, Barneby House, Bossall, Barton-le-Willows, Yorks, for *Donald*, chestnut, bred by Alfred Kelsey, Market Weighton; s. Prince Henry 3rd 5759, d. by Wildfire 1224.
- 326 B. N. & Com.—CHRISTOPHER HARRISON, for *Donald*.

**Class 37.—Hackney Fillies, foaled in 1897.<sup>1</sup>**

[6 entries, 1 absent.]

- 334 I. (£15, & B. N. for Champion.)—HENRY MOORE, Burn Butts, Cranswick, Hull, for *Lobelia* 12055, brown; s. Chocolate Junior 4185, d. Wildflower 883 by Denmark 177.
- 332 II. (£10.)—HARRY LIVERSEY, Rotherfield, Sussex, for *Walsome* 12375, chestnut, bred by J. W. Crossley, Brian Royd, Greetland, Halifax; s. Connaught 1453, d. Althorp Queen 1421 by Confidence 163.
- 329 B. N. & H. C.—HERBERT B. CORY, for *Druidstone Duchess*.
- 331 Com.—WM. P. KIRBY, for *W. P. K's Belle*.

**Class 38.—Hackney Geldings, foaled in 1898.<sup>1</sup>**

[3 entries, 2 absent.]

- 337 I. (£15.)—ANDREW MOSCROP, Thorganby Hall, York, for *Rufus*, chestnut; s. Romeo 3rd 3248, d. Queen by Royal Arthur 3913.

**Class 39.—Hackney Fillies, foaled in 1898.**

[11 entries, 1 absent.]

- 344 I. (£15.)—HENRY LIDDELL-GRAINGER, Ayton Castle, N.B., for *Ayton Sweet Nancy* 12420, chestnut; s. His Majesty 2513, d. Flirt 1110 by Confidence 163.
- 342 II. (£10.)—SIR WALTER GILBEY, BT., Elsenham Hall, Essex, for *Bonny Lady* 12481, chestnut; s. Royal Danegelt 5785, d. Lady Dunham 2894 by Cadet 1251.
- 346 III. (£5.)—LORD MIDDLETON, Birdsall House, York, for *Birdsall Daisy Belle* 12459, chestnut; s. Rosador 4964, d. Daisy Trifittina 6548 by Fireaway 249.
- 341 B. N. & H. C.—E. EDMONDSON, Springfield Hall, Knowle, for *Knowle Denise*.  
Com.—H. B. CORY, for No. 338, *Druidstone Kathleen*; H. CREASER, for No. 340, *White Socks*; LEES KNOWLES, M.P., for No. 343, *Salford Miranda*; J. MAJOR, for No. 345, *Autocrat Queen*.

**Class 40.—Hackney Colts or Geldings, foaled in 1899.<sup>1</sup>**

[2 entries, 1 absent.]

- 350 I. (£10.)—C. H. HART, Appletree Farm, York, for *Londesbro'*, bay colt; s. Polonius 4931, d. Crafty 1063 by Denmark 177.

**Class 41.—Hackney Fillies, foaled in 1899.**

[7 entries, 1 absent.]

- 352 I. (£10.)—AUSTIN C. CARR, Broxton Lower Hall, Chester, for *Rosaletta*, chestnut, bred by David Beal, Wharram Percy, Wharram, York; s. Rosador 4964, d. Country Fashion 7733 by Garton Duke of Connaught 3009.
- 354 II. (£5.)—ROBERT HUSSEY, Eastfields, Lichfield, for *Puzzle*, chestnut, bred by G. M. Gale, Atwick, Yorks; s. Atwick Surprise 5092, d. Lady Isabel 1638 by Danegelt 174.
- 353 B. N. & H. C.—E. EDMONDSON, for *Knowle Brocade*.
- 356 Com.—JOHN SHAW, for *Faxfleet Molly*.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Gold Medal given by the Hackney Horse Society for the best Hackney Mare or Filly exhibited in Classes 34, 35, 37, 39, and 41.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 42.—Hackney Mares or Geldings, foaled in 1894, 1895, or 1896, to carry 15 stones and upwards.<sup>1</sup> [10 entries, 1 absent.]**

- 361 I. (£15).—THOMAS HALL, East Farm, Langton, Malton, for *Lord Langton*, chestnut gelding, foaled 1895; s. Garton Duke of Connaught 3009, d. Kynnythorpe Lady 3985 by Matchless of Londesboro' 1517.
- 358 II. (£10).—E. & A. BAXTER, Hutton Hackney Stud, Brentwood, for *Lady Nell* 9155, bay mare, foaled 1894, bred by H. Hind, Highfield, Wyke, Bradford; s. Danger 4216, d. Nellie Bly 4477 by Robin Adair 1545.
- 360 III. (£5).—ARTHUR FEWSON, Hedon, Hull, for *Lady Lottie* 12824, chestnut mare, foaled 1895, bred by James Close, East Field, Patrington, Hull; s. Diviner 3543, d. by Rising Hope 3244.
- 366 B. N. & H. C.—H. WATSON, Newton Kyme, Tadcaster, for *Newton Swell*.

**Class 43.—Hackney Mares or Geldings, foaled in 1894, 1895, or 1896, to carry 12 stones and under 15 stones.<sup>1</sup> [10 entries, 3 absent.]**

- 370 I. (£15).—A. L. GOODSON, Heathfield, Knutsford, for *Conceit* 10785, chestnut mare, foaled 1896, bred by the Earl of Londesborough, Londesborough Park, Market Weighton; s. Polonius 4931, d. Vanity 2490 by Candidate 920.
- 372 II. (£10).—MRS. FRED. HOLMES, Staveley Grange, Shipley, Yorks, for *Pickwick*, chestnut gelding, foaled 1895, bred by T. Cooper, Brookfoot Farm, Birkenshaw, Leeds; s. Ganymede 2076, d. Judy 9023 by Neptune 3rd 4425.
- 369 III. (£5).—ARTHUR FEWSON, Hedon, Hull, for *Gallant* 6745, chestnut gelding, foaled 1896, bred by J. L. Leake, Elsternwick, Hull; s. Hedon Swell, 4807, d. Madeline 3019 by Danegelt 174.
- 873 B. N. & H. C.—WM. P. KIRBY, Watton, Beverley, for *Summer Belle*.
- 875 Com.—H. T. PARKE, for *Chalice*.

## Ponies.

**Class 44.—Pony Stallions, not exceeding 14 hands.  
[11 entries, 2 absent.]**

- 382 I. (£15).—JOHN JONES, Whitegate Stud, Wrexham, for *Whitegate Swell* 6983, bay, foaled 1894, bred by E. W. Wilson, Harpley Dams, Wellington; s. Cassius 2897, d. Sarah Bernhardt 9503 by Don Carlos 183.
- 378 II. (£10).—T. T. CAMPION, Carr House, East Heslerton, York, for *Benjamin* 3rd 6648, chestnut, foaled 1896; s. Jesuit 5243, d. Betsy No. 1208 Inspected F.S.
- 386 III. (£5).—JOHN MAKEAGUE, Golborne Park, Newton-le-Willows, Lancs., for *Fompositus* 6502, brown, foaled 1895; s. Berkeley Model (late Heacham Model) 3663, d. Bravo No. 1036 Inspected F.S.
- 388 B. N. & H. C.—S. WOODIWISS, Graveleys, Great Waltham, for *Hexham*.
- 381 H. C.—WILLIAM HOLLINS, for *Confident George*.

**Class 45.—Pony Mares (with Foals at foot), not exceeding 14 hands.  
[10 entries, 1 absent.]**

- 390 I. (£15).—ALFRED S. DAY, Berkeley Stud, Crewe, for *Magie* No. 966 F.S., brown, foaled 1888 [foal by Winnal George (late Disappointment) 2440], bred by Robert Clarke, Tacolnestone, Wymondham; s. Colt by Dr. Syntax 877, d. Topsy No. 1100 Inspected F.S. by Prickwillow 1100.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 397 II. (£10).—EUSTACE SMITH, Benton House, Newcastle-on-Tyne, for Lady Middleton No. 1068 F.S., chestnut, foaled 1889 [foal by Tom-Tit 2nd 5040], bred by Frank Usher, Market Weighton; s. Matchless of Londesboro' 1517.
- 395 III. (£5).—HERBERT T. PARKE, Withnell Fold, Chorley, Lancs, for Handy Jane 10999, grey, foaled 1891 [foal by Model 1054], bred by A. E. Grice, Ganton, York; s. Freeman 2072, d. by Lord Derby 2nd 417.
- 398 B. N. & H. C.—S. WOODIWISS, Great Waltham, for Dame Fortune.
- 396 H. C.—A. P. ROBINSON, for Lady Poma.
- 391 Com.—WM. HOLLINS, for Gladiola.

**Class 46.—Pony Mares or Geldings, above 13 hands 2 inches, and not exceeding 14 hands 2 inches.<sup>1</sup> [11 entries, 1 absent.]**

- 408 I. (£10).—FRANK RILEY-SMITH, Saxham Hall, Bury St. Edmunds, for Inholmes Mystery 8996, chestnut mare, foaled 1894; s. Lord Hamlet 3750, d. Mishap 7130 by Lord Rattler 2566.
- 399 II. (£5).—E. & A. BAXTER, Hutton Hackney Stud, Brentwood, for Miss Howard 12134, bay mare, foaled 1893, bred by W. Rook, Bielby, Everingham, Yorks; s. Sensation 6th 3265, d. Bielby Princess 5034 by King Charley 392.
- 409 III. (£3).—EUSTACE SMITH, Benton House, Newcastle-on-Tyne, for Wild Lucy 11573, brown mare, foaled 1895, bred by P. & T. Deighton, North Duffield, Selby; s. Wildfire 1224, d. Lucy Bother'em 3015 by Danegelt 174.
- 410 B. N. & H. C.—J. & H. P. WEBSTER, Brompton, R.S.O., Yorks, for Miss Danegelt.
- 401 H. C.—ALFRED S. DAY, for Kenley Dagmar.
- 407 Com.—WM. HOLLINS, for Jemima.

**Class 47.—Pony Mares or Geldings, under 13 hands 2 inches.<sup>1</sup> [9 entries, none absent.]**

- 411 I. (£10).—G. E. FRANKLIN, The Field, Derby, for Dandy Dan, roan gelding, foaled 1895.
- 413 II. (£5).—WM. HOLLINS, Pleasley Vale, Mansfield, Notts, for Little Britannia No. 1158 F. S., bay mare, foaled 1892.
- 414 III. (£3).—JOHN MAKEAGUE, Golborne Park, Newton-le-Willows, Lancs., for Encore 11789, brown mare, foaled 1897; s. Sir Horace 5402, d. Bravo No. 1036 Inspected F.S.
- 412 B. N. & H. C.—ALEX. GEMMELL, Chelston, Ayr, for Ayrshire Gem.
- 417 Com.—A. P. ROBINSON, for Little Bebs.

**Shetland Ponies.**

**Class 48.—Shetland Pony Stallions, not exceeding 10½ hands, foaled before or in 1897.<sup>1</sup> [5 entries, none absent.]**

- 419 I. (£7).—THE LADIES E. and D. HOPE, Great Hollenden Farm, Under River, Sevenoaks, for Oman 33, brown, foaled 1885, bred by the Marquis of Londonderry, K.G., Bressay, Shetland; s. Prince of Thule 36, d. Norma 198 by Lord of the Isles 26.
- 422 II. (£3).—R. W. R. MACKENZIE, Earlsall, Leuchars, Fife, for Rattler, brown, foaled 1895, bred by Gavin Hadden, Dalmuinzie, Murtle, Aberdeenshire; s. Mulum in Parvo 28, d. Moonlight 469 by Giant 10.
- 420 B. N. & H. C.—THE LADIES E. and D. HOPE, Under River, for Vulcan.
- 423 Com.—SAM WOODIWISS, for Reuben.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 49.—Shetland Pony Mares, not exceeding 10½ hands, foaled before or in 1897.**<sup>1</sup> [6 entries, none absent.]

- 424 I. (£7.)—THE LADIES E. and D. HOPE, Great Hollenden Farm, Under River, Sevenoaks, for *Bretta* 811, black, foaled 1888, bred by the Marquis of Londonderry, K.G., Bressay, Shetland; s. *Odin* 82, d. *Beauty* 167 by Lord of the Isles 26.  
 425 II. (£3.)—THE LADIES E. and D. HOPE, for *Vementry* 8nd 1104, brown, foaled 1892, bred by the Marquis of Londonderry, K.G., Bressay, Shetland; s. Lord of the Isles 26, d. *Vesta* 215 by Prince of Thule 36.  
 426 R. N. & H. C.—MRS. WENTWORTH HOPE JOHNSTONE, for *Sapphire*.  
 427 Com.—MRS. WENTWORTH HOPE JOHNSTONE, for *Skylark*.

## Mountain and Moorland Ponies.

(Including Fell, Dartmoor, Exmoor, New Forest and Welsh Breeds.)

**Class 50.—Mountain or Moorland Pony Stallions, not exceeding 13 hands 2 inches, foaled before or in 1897.** [3 entries.]

431. I. (£10.)—H. MEURIC LLOYD, Glannyrannell, Llanwrda, Carmarthen-shire, for *Starlight* 167, grey, foaled 1894; s. *Glassalt*, d. *Moonlight* 908.  
 430 II. (£5.)—LORDS A. and L. CECIL, Orchardmains, Tonbridge, for *Lindisfarne*, brown, foaled 1894; s. *Marmion*, d. *Scalpa* by Hebridean.  
 432 R. N. & H. C.—THE DUCHESS OF NEWCASTLE, for *Hardwick Briton*.

**Class 51.—Mountain or Moorland Pony Mares, not exceeding 13 hands 2 inches, foaled before or in 1897.** [8 entries, 2 absent.]

- 435 I. (£10.)—JOHN JONES & SON, Dinarth Hall Pony Stud, Colwyn Bay, Denbighshire, for *Buttington Jessie*, bay, foaled 1891, bred by E. Kinsey, Buttington Hall, Welshpool.  
 436 II. (£3.)—JOHN JONES & SON, Colwyn Bay, for *Welsh Diamond*, black, foaled 1895, bred by E. Thomas, Capel Tydist, Llandilo.  
 438 R. N. & H. C.—THE DUCHESS OF NEWCASTLE, for *Clamber Jenny*.  
 434 Com.—LORDS A. and L. CECIL, for *Crackenthorpe*.

## Polo Ponies.

**Class 52.—Polo Pony Stallions, not exceeding 14 hands 2 inches.**<sup>1</sup>  
 [5 entries, none absent.]

- 442 I. (£20, & Champion.)—SIR WALTER GILBEY, BT., Elsenham Hall, Essex, for *Rosewater* 37, bay, foaled 1883, bred by A. W. Elphick, Preston Park, Brighton; s. *Boscruclan*, d. *Lady Day* II. by Saint Mungo.  
 443 II. (£10, & R. N. for Champion.)—JOHN JONES & SON, Dinarth Hall Pony Stud, Colwyn Bay, Denbighshire, for *Gewnboy* 114, chestnut, foaled 1896, bred by S. Hughes Hewitt, Sports Club, London; s. *Montezuma*, d. *Santa Zita* by Galliard.  
 441 III. (£5.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts, for *Sandway* 121, bay, foaled 1895, bred by Sir H. F. de Trafford, Bt., Trafford Park, Manchester; s. *Rosewater* 37, d. *Cuddington* 50 by Cucumber.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Gold Medal given by the Polo Pony Society for the best Polo Pony Stallion exhibited in Classes 52 and 53.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 53.—Polo Pony Stallions (*Eastern Ponies*), not exceeding 14 hands 2 inches.<sup>1</sup> [4 entries, none absent.]**

- 449 I. (£15.)—REV. D. B. MONTEFIORE, Mursley, Winslow, Bucks, for Mootrub 32, chestnut, foaled 1896, imported from Calcutta.  
 448 II. (£10.)—G. NORRIS MIDWOOD, The Hut, Tabley, Knutsford, for The Bey 108, bay, foaled 1886, bred in Arabia, Tahowi breed.

**Class 54.—Polo Pony Mares, above 13 hands 2 inches and not exceeding 14 hands 2 inches, with Foals at foot, or to Foal in 1900.<sup>1</sup> [7 entries, 1 absent.]**

- 450 I. (£15.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts., for Lightning 726, chestnut, aged [in foal to Sandiway 121].  
 448 II. (£7.)—SIR H. F. DE TRAFFORD, BT., Hill Crest, Market Harborough, for Confidential, bay, foaled 1893 [foal by Ehen]; s. Rosewater 37, d. The Secret 287.  
 451 III. (£3.)—JOHN BARKER, Bishop's Stortford, for Serf Bell 504, bay, foaled 1894 [in foal to Rosewater 37], bred by F. J. Grainger, Thornholme, Burton Agnes, Hull; s. Southampton, d. Gazelle by King of the Forest.  
 455 R. N. & H. C.—KEYNSHAM STUD CO., Keynsham, Somerset, for Oh My. Com.—W. H. COOKE, for No. 452, Luck; SIR H. F. DE TRAFFORD, BT., for No. 454, Eau-de-Rose.

**Class 55.—Polo Pony Colts, Geldings, or Fillies, foaled in 1897, not exceeding 14 hands 1 inch.<sup>1</sup> [7 entries, none absent.]**

- 459 I. (£10.)—G. NORRIS MIDWOOD, The Hut, Tabley, Knutsford, for Hazel 709, chestnut filly, bred by T. Hazelhurst, Plumbley, Knutsford; s. The Bey 108.  
 458 II. (£7.)—KEYNSHAM STUD CO., Keynsham, Somerset, for Birmingham Royal 127, chestnut colt, bred by Stuart Forster, Postlip Hall, Winchcombe; s. Mootrub 32, d. Sally 668.  
 463 III. (£3.)—JOHN WILKINSON, Crofton Grange, Wakefield, for Hermit, dun colt; s. The Monk 49, d. Sybil 281.  
 460 R. N. & H. C.—T. PERCIVAL, Ash Grove, Knottingley, for Little Nun.

**Class 56.—Polo Pony Colts, Geldings, or Fillies, foaled in 1898, not exceeding 14 hands.<sup>1</sup> [8 entries, 2 absent.]**

- 464 I. (£10.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts, for Lady Polo, chestnut filly, bred by G. Baynes, Broxted Hall, Dunmow, Essex; s. Lord Polo 135, d. Kate by Kahelat.  
 468 II. (£7.)—SIR H. F. DE TRAFFORD, BT., Hill Crest, Market Harborough, for Rosemary, chestnut filly; s. Rosewater 37, d. Flirt 84.  
 469 III. (£3.)—KEYNSHAM STUD CO., Keynsham, Somerset, for Maidstone Royal 136, chestnut colt, bred by Stuart Forster, Postlip Hall, Winchcombe; s. Mootrub 32, d. Sally 668.  
 466 R. N. & Com.—SIR H. F. DE TRAFFORD, BT., for Bobby.

**Class 57.—Polo Pony Colts, Geldings, or Fillies, foaled in 1899.<sup>1</sup> [10 entries, 3 absent.]**

- 474 I. (£10.)—JOHN BARKER, The Grange, Bishop's Stortford, Herts., for Summer Lightning, bay filly; s. Sandiway 121, d. Lightning 726.

<sup>1</sup> Prizes offered by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 472 II. (£7.)—JOHN BARKER, Bishop's Stortford, for Baby Girl, bay filly; s. Sandiway 121, d. Portia 660 *by* Special Pleader.
- 475 III. (£3.)—JAMES S. DARBELL, West Ayton, York, for brown colt; s. Escamillo, d. Tornado.
- 473 B. N. & H. C.—JOHN BARKER, for Jeanette.
- 479 Com.—G. NORRIS MIDWOOD, for Houp-la.

## Harness Horses and Ponies.

**Class 58.—*Harness Mares or Geldings, of any age, above 15 hands.*<sup>1</sup> [7 entries, 4 absent.]**

- 486 I. (£15.)—TOM MITCHELL, The Park, Eccleshill, Bradford, for Sam Weller, chestnut gelding, foaled 1894; s. Ganymede 2076, d. Mischievous *by* Prince George.
- 487 II. (£10.)—MARK PEARSON, Yorkshire Stables, Harrogate, for Lord Lefty, bay gelding, foaled 1884, bred by Tom Mitchell, The Park, Eccleshill, Bradford; s. Ganymede 2076, d. Bowling Belle 6427 *by* Star of the West 3rd 3981.
- 485 B. N.—E. C. MEYSEY-THOMPSON, for Lord Roberts.

**Class 59.—*Harness Mares or Geldings of any age, above 14 and not exceeding 15 hands.*<sup>1</sup> [14 entries, 6 absent.]**

- 492 I. (£15.)—E. S. GODSELL, Stroud, Glos., for Heathfield Squire (late Fortinbras) 5207, chestnut gelding, foaled 1893, bred by the late Earl of Lonsborough, Lonsborough Park, Market Weighton; s. Wildfire 1224, d. Ophelia 1301 *by* Denmark 177 or Danegelt 174.
- 495 II. (£10.)—HERBERT T. PARKE, Withnell Fold, Chorley, Lancs., for Lady Love (late Sadie) 9497, bay mare, foaled 1890, bred by Wm. Wing, Newton, Wisbech; s. Neatmore 1864, d. Lady Newton 2949 *by* Lord Bardolph 412.
- 498 III. (£5.)—MRS. FRED HOLMES, Staveley Grange, Shipley, Yorks, for Jenny Lind 11028, bay mare, foaled 1894, bred by C. Hutchinson, Sancton Grange, Brough; s. His Majesty 2613, d. Lady Foston 2186 *by* Foston Fireaway 288.
- 491 B. N. & H. C.—CHARLES FOWLER, Lincoln, for Lord Lincoln.
- 500 H. C.—GEORGE TYSON, for Love Better.
- 502 Com.—G. O. WAUD, for Ferniehurst Frivolous.

**Class 60.—*Harness Pony Mares or Geldings, of any age, not exceeding 14 hands.*<sup>1</sup> [10 entries, 3 absent.]**

- 505 I. (£15.)—WILLIAM FOSTER, Mel-Valley, Moseley, Worcs., for Mel-Valley Princess 12928, black mare, foaled 1895, bred by Walter Dodd, Gayton, King's Lynn; s. Recruit 1884, d. Black Bess 6408 *by* Recruit 1884.
- 506 II. (£10.)—GEORGE E. FRANKLIN, The Field, Derby, for Lord Gobang, bay gelding, foaled 1892, bred by Charles Manning, Northampton; s. Fashion, d. Welsh Pony.
- 504 III. (£5.)—ALFRED S. DAY, Berkeley Stud, Crewe, for Sunshine 11507, chestnut mare, foaled 1894, bred by E. M. Connop, Rollesby, Great Yarmouth; s. Cassius 2397, d. Rosa Bonheur 3236 *by* Confidence 158.
- 510 B. N. & H. C.—A. P. ROBINSON, Wakefield, for Lady Gelightly.
- 507 H. C.—ISAAC GARNETT, for McGinty.
- 511 Com.—J. A. STAVELEY, for Lovely Lottie.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## Shires.

### Class 61.—*Shire Stallions, foaled in 1897.* [5 entries, 1 absent.]

- 518 I. (£20, & R. N. for Champion.<sup>1</sup>)—EDWARD GREEN, The Moors, Welshpool, for *Moors Regent* 17492, brown, bred by E. Jones & Sons, Pool Quay, Welshpool; s. *Regent* 2nd 6316, d. *Bertha* 19316 by *Carbon* 3523.
- 514 II. (£10.)—ARTHUR RANSOM, Hitchin, Herts., for *Hitchin Ringleader* 17397, bay, bred by E. E. Harcourt-Vernon, Grove, Retford; s. *Calwich Heirloom* 14647, d. *Grove Vera* 28786 by *Harold* 3703.
- 517 E. N. & H. C.—JOSEPH WAINWRIGHT, Buxton, for *Becks Chief*.
- 515 H. C.—LORD ROTHSCHILD, for *Jubilee Victor*.

### Class 62.—*Shire Stallions, foaled in 1898.* [12 entries, 2 absent.]

- 526 I. (£20, & Champion.<sup>1</sup>)—LORD LLANGATTOCK, The Hendre, Monmouth, for *Hendre Hydrometer* 18082, black; s. *Prince Harold* 14228, d. *Puckrup Folly* 17237 by *Hydrometer* 3744.
- 519 II. (£10.)—EARL EGERTON OF TATTON, Tatton Park, Knutsford, for *Tatton Victorious*, black; s. *Bury Victor Chief* 11105, d. *Tatton Blackbird* 24946 by *The Moor* 10629.
- 527 III. (£5.)—P. ALBERT MUNTZ, M.P., Dunsmore, Rugby, for *Dunsmore John o' Gaunt* 17976, bay, bred by Wm. Dunn, Clifton, Rugby; s. *Dunsmore Masterman* 12874, d. *Clifton Fuchsia* 19643 by *Dunsmore Willington Boy* 13021.
- 521 E. N. & H. C.—JAMES FORSHAW, Carlton-on-Trent, for *King Carlton*.
- H. C.—JAMES FORSHAW, for No. 520, *D'Arcy Albert*; SIR J. BLUNDELL MAPLE, BT., M.P., for No. 526, *Old Times* 6th.

### Class 63.—*Shire Stallions, foaled in 1899.* [11 entries, 4 absent.]

- 535 I. (£15.)—LORD LLANGATTOCK, The Hendre, Monmouth, for *Victor of Waresley*, bay, bred by Capt. W. H. O. Duncombe, Waresley Park, Hunts; s. *Waresley Triumph* 16453, d. *Packington Brave Girl* 13117 by *Measham Chief* 6124.
- 536 II. (£10.)—SIR J. BLUNDELL MAPLE, BT., M.P., Childwick, St. Albans, for *Buscot Squire*, bay, bred by A. Henderson, M.P., Buscot Park, Faringdon; s. *Markeaton Royal Harold* 15225, d. *Madryn Bonny Lass* 16956 by *Willington Sir John* 8609.
- 538 III. (£5.)—JOHN PARNELL, Rainsbrook, Rugby, for *Lockinge Lord*, brown, bred by Lord Wantage, K.C.B., V.O., Lockinge, Wantage; s. *Lockinge Albert* 15695, d. *Lockinge Flower* 24187 by *Prince Harold* 14228.
- 532 E. N. & H. C.—VICTOR C. W. CAVENDISH, M.P., for *Holker Chief*.
- H. C.—H.R.H. THE PRINCE OF WALES, K.G., for No. 530, *Holdfast*; GEORGE OSBENTON, for No. 537, *Eden Duke*.

### Class 64.—*Shire Mares (with Foals at foot).* [7 entries, 2 absent.]

- 543 I. (£20, & R. N. for Champion.<sup>2</sup>)—SIR J. BLUNDELL MAPLE, BT., M.P., Childwick, St. Albans, for *Stanney Commotion* 24812, bay, foaled 1896 [foal by *Bury Victor Chief* 11105], bred by Wm. Parker, Great Stanney Hall, Sutton, Chester; s. *Seldom Seen* 15348, d. *Stanney Pride* 22502 by *Vulcan* 4145.

<sup>1</sup> Champion Gold Medal given by the Shire Horse Society for the best Shire Stallion exhibited in Classes 61-63.

<sup>2</sup> Champion Gold Medal given by the Shire Horse Society for the best Shire Mare or Filly exhibited in Classes 64-67.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 545 II. (£10).—LORD ROTHSCHILD, Tring Park, Herts., for Blythwood Nora 16184, brown, foaled 1892 [foal by Hendre Marksman 16715], bred by Sir James Blyth, Bt., Blythwood, Stansted; s. Norman Conqueror 7940, d. Sparklike 7076 by Spark 2497.
- 542 III. (£5).—JAMES FORSHAW, Carlton-on-Trent, Newark, for Tom's Flower 21042, bay, foaled 1892 [foal by Nailstone Cœur-de-Lion 16269], bred by J. T. Gourley, Torksey, Lincoln; s. Honest Tom 5123, d. Flower 18216 by Bold Lincoln 2nd 2725.
- 547 R. N. & H. C.—H. H. SMITH-CARINGTON, Ashby Folville Manor, Melton Mowbray, for Hendre Crown Princess.
- 544 H. C.—P. ALBERT MUNTZ, M.P., for Lady Franklin.

**Class 65.—Shire Fillies, foaled in 1897. [11 entries, 2 absent.]**

- 553 I. (£15, & Champion).—SIR J. BLUNDELL MAPLE, BT., M.P., Childwick, St. Albans, for Victor's Queen 27158, black, bred by H.R.H. The Prince of Wales, K.G., Sandringham; s. Bury Victor Chief 11105, d. Solace 24787 by Lord Arthur 9834.
- 550 II. (£10).—JAMES FORSHAW, Carlton-on-Trent, Newark, for Whaplode Countess 30436, bay, bred by Joseph Ward, Moulton, Spalding; s. Horbling Hereward 14102, d. Whaplode Flower 30438 by Weston Squire 8579.
- 555 III. (£5).—JOHN PARNELL, Rainsbrook, Rugby, for Rokeby Judith 29856, grey, bred by R. T. Bowers, Grendon House, Northampton; s. Jeroboam 15172, d. Flower 28584 by Calthorpe Vulcan 12906.
- 557 R. N. & H. C.—LORD ROTHSCHILD, for Worsley Princess 6th.
- 556 H. C.—JOHN PARNELL, for Tatton Juliet.
- 558 Com.—H. H. SMITH-CARINGTON, for Rocks Madam.

**Class 66.—Shire Fillies, foaled in 1898. [13 entries, 4 absent.]**

- 563 I. (£15).—WILLIAM JACKSON, The Hall, Knottingley, Yorks., for Holker B. I. 28930, brown, bred by Victor C. W. Cavendish, M.P., Holker Hall, Carnforth; s. Markeaton Royal Harold 15225, d. Saxon Empress 24685 by Harold 3703.
- 571 II. (£10).—R. A. YERBURGH, M.P., Woodfold Park, Blackburn, for Lily of the Valley 29239, brown, bred by W. O. Goulding, The Field, Whatton-in-the-Vale, Notts.; s. Southgate Honest Tom 16984, d. Bonny Lass 21374 by Royal Briton 2nd 13527.
- 565 III. (£5).—SIR J. BLUNDELL MAPLE, BT., M.P., Childwick, St. Albans, for Saxon Talent 29958, bay, bred by Sir Walter Gilbey, Bt., Elsenham Hall, Essex; s. Marmion 2nd 9885, d. Whitstone Talent 17610 by First Lord 7235.
- 566 R. N. & H. C.—P. ALBERT MUNTZ, M.P., for Dunsmore June Rose.
- H. C.—FRED CRISP, for No. 559, Girtan Sunlight; E. E. HARCOURT-VERNON, for No. 561, Grove Rhea.

**Class 67.—Shire Fillies, foaled in 1899. [17 entries, 6 absent.]**

- 576 I. (£15).—EARL EGERTON OF TATTON, Tatton Park, Knutsford, for Lookinge Athena, brown, bred by Lord Wantage, K.C.B., V.O., Lockinge, Wantage; s. Prince William 3956, d. Dunsmore Gipsy 21707 by Dunsmore Masterman 12874.
- 575 II. (£10).—JAMES EADIE, Barrow Hall, Derby, for Barrow Princess, bay; s. Harold 3703, d. Carlton Lady 17952 by Hydrometer 3744.

\* Champion Gold Medal given by the Shire Horse Society for the best Shire Mare or Filly exhibited in Classes 64-67.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 572 III. (£5.)—H.R.H. THE PRINCE OF WALES, K.G., Sandringham, for Maidenhair, bay, bred by Wm. Sargeant, Churnet Grange, Cheddleton, Staffs; s. Harold 3703, d. Princess Mary 17231 by Premier 2646.
- 584 B. N. & H. C.—P. ALBERT MUNTZ, M.P., for Dunsmore Luck.  
H. C.—JOHN PARNELL, for No. 585, Rokeyby Hora; HON. N. C. ROTHSCHILD, for No. 586, First Fruit.
- 579 Com.—R. W. HUDSON, for Holker Crown of Roses.

## Clydesdales.

### Class 68.—*Clydesdale Stallions, foaled in 1897.*

[4 entries, none absent.]

- 592 I. (£15.)—THOMAS SMITH, Blaon Point, Chester, for Drumflower 10537, brown, bred by Robert Frederick, Drumflower, Dunragit; s. Macgregor 1487, d. Young Sarah Bernhardt 13075 by Prince of Wales 673.
- 591 II. (£10.)—LEONARD PILKINGTON, Cavens, Dumfries, for Marshal Niel 10815, bay; s. Prince Sturdy 10112, d. Queen of the Roses 12302 by Prince of Albion 6178.
- 589 III. (£5.)—H.M. THE QUEEN, Osborne, Isle of Wight, for Baron Bombie 10498, bay, bred by Wm. Nicholson, Bombie, Kirkcudbright; s. Baron's Pride 9122, d. Kate of Bombie 13220 by Macgregor 1487.

### Class 69.—*Clydesdale Stallions, foaled in 1898.*

[4 entries, none absent.]

- 596 I. (£15.)—HERBERT WEBSTER, Morton House, Fence Houses, co. Durham, for Baron's Crown 10679, bay, bred by Wm. Hood, Chapleton, Borgue, Kirkcudbright; s. Baron's Pride 9122, d. Sally Walker 11815 by Prince Lawrence.
- 593 II. (£10.)—LORDS A. and L. CECIL, Orchardmains, Tonbridge, for Baron Briton 10678, bay, bred by David Dunn, Roxburgh Mains, N.B.; s. Baron's Pride, 9122, d. Garthland Queen 13413 by Lawrence's Heir 6931.
- 594 III. (£5.)—THOMAS SMITH, Blaon Point, Chester, for Pleasant Prince 10835, black; s. Prince Pleasing 10259, d. Belle of Fashion 12924 by Prince of Fashion.

### Class 70.—*Clydesdale Stallions, foaled in 1899.*

[5 entries, 1 absent.]

- 597 I. (£15.)—LORDS A. and L. CECIL, Orchardmains, Tonbridge, for Baronial Guard, bay; s. Montrave Sentinel 10094, d. Baroness Chastlar 13738 by Baron's Pride 9122.
- 600 II. (£10.)—THOMAS SMITH, Blaon Point, Chester, for Village Boss, bay; s. Prince Pleasing 10259, d. Baroness 13609 by The Summit 9442.

### Class 71.—*Clydesdale Mares (with Foals at foot).*

[3 entries, none absent.]

- 604 I. (£15.)—JOHN T. PEACOCK, Low Newport Farm, Sunderland, for Queen of Gretna 12895, brown, foaled 1892 [foal by Scottish Crown 9851], bred by John Ellwood, Stonehouse, Gretna; s. Belted Prince 8459, d. Lofty of Stonehouse 12458 by Nelson 1493.
- 603 II. (£10.)—THE EARL OF DEBBY, K.G., Knowsley, Prescott, for Miss Warden 13246, bay, foaled 1893 [foal by Earl of Haulkerton 10189], bred by Ivie Warden, Easter Cowden, Dalkeith; s. Gerard 8651, d. Cowden Maggie 12358 by Jordanshaw 3343.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 72.—*Clydesdale Fillies, foaled in 1897.* [6 entries, 4 absent.]**

606 I. (£15).—THOMAS SMITH, Blacon Point, Chester, for *Jenny Deans*, bay ;  
s. Baron's Pride 9122, d. Jean Macgregor 13278 by Macgregor 1487.

**Class 73.—*Clydesdale Fillies, foaled in 1898.* [8 entries, 1 absent.]**

615 I. (£15).—R. SINCLAIR SCOTT, Burnside, Largs, N.B., for *Scottish Baroness*, black, bred by James Phillips, Carse, Kirkcudbright ; s. Baron's Pride 9122, d. Jean 2nd 1639 by Prince of Kelvin 656.

616 II. (£10).—THOMAS SMITH, Blacon Point, Chester, for *Cedric Princess*, bay ; s. Baron's Pride 9122, d. Fickle Fortune Princess 2nd 12879 by Cedric 1087.

618 III. (£5).—HERBERT WEBSTER, Morton House, Fence Houses, co. Durham, for *Lady Florence*, brown, bred by James Picken, Torrs Farm, Kirkcudbright ; s. Baron's Pride 9122, d. Mabel of Torrs 13571 by Prince Romeo 8144.

610 B. N. & H. C.—LORDS A. and L. CECIL, Orchardmains, Tonbridge.

617 H. C.—THOMAS SMITH, for *Village Beauty*.

612 Com.—LONDONDERBY STUD CO.

**Suffolks.**

**Class 74.—*Suffolk Stallions, foaled in 1897.* [5 entries, 1 absent.]**

622 I. (£15).—A. H. E. WOOD, Sudbourn Hall, Wickham Market, for *Sudbourn Brownie* 2886, chestnut ; bred by Sir Cuthbert Quilter, Bt., M.P., Bawdsey Manor, Woodbridge ; s. Prince Wedgewood 2361, d. Sprite by Checkmate 1566.

620 II. (£10).—SIR CUTHBERT QUILTER, Bt., M.P., Bawdsey Manor, Woodbridge, for *Bawdsey Willie* 2725, chestnut ; s. Prince Wedgewood 2361 d. Bawdsey Dolly 3611 by Czar 1754.

619 III. (£5).—C. H. BERNERS, Woolverstone Park, Ipswich, for *Sunshine* 2734, chestnut, bred by E. J. Johnstone, Rougham Hall, Bury St. Edmunds ; s. Eclipse 2627, d. Mercy 3953 by Wedgewood 1749.

621 B. N.—A. J. SMITH, Rendlesham, for *Rendlesham Cupbearer*.

**Class 75.—*Suffolk Stallions, foaled in 1898.* [8 entries, 1 absent.]**

629 I. (£15).—A. H. E. WOOD, Sudbourn Hall, Wickham Market, for *Sudbourn King of Tramps* 2794, chestnut, bred by the Trustees of the late Duke of Hamilton, Easton Park, Wickham Market ; s. Eclipse 2627, d. Sudbourn Queen of Tramps 4330 by Cupbearer 3rd 566.

625 II. (£10).—ARTHUR T. PRATT, Sproughton Hall, Ipswich, for *Fireaway* 2785, chestnut, bred by Hon. W. F. D. Smith, M.P., Great Thurlow, Suffolk ; s. Firefly 2477, d. Nancy 3665 by Donny 1618.

630 III. (£5).—A. H. E. WOOD, Sudbourn Hall, for *Sudbourn Sirdar* 2789, chestnut, bred by W. E. Long, Hurts Hall, Saxmundham ; s. Eclipse 2627, d. Sudbourn Sally 4388 by Verger 1550.

626 B. N. & H. C.—EDWARD F. QUILTER, Ipswich, for *Bentley Luck*.

627 Com.—A. J. SMITH, for *Lord Kitchener*.

**Class 76.—*Suffolk Stallions foaled in 1899.* [6 entries, 2 absent.]**

637 I. (£15).—A. H. E. WOOD, Sudbourn Hall, Wickham Market, for *Sudbourn Chief*, 2907, chestnut, bred by C. H. Berners, Woolverstone Park, Ipswich ; s. Windsor Chieftain 2025, d. Harstead Gem 3746 by Warrior 1938.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 635 II. (£10).—EDWARD F. QUILTER, Hill House, Belstead, Ipswich, for Bentley Victor 2815, chestnut; s. Prince Wedgewood 2364, d. Vesta 3395 by Major Snap 155.  
 633 III. (£5).—ROBERT EDGAR, Knight's Hill, Cockfield, Bury St. Edmunds, for Tit Up 2840, chestnut; s. Friston Hero 2624, d. Apology 2678 by Titwillow 1696.  
 636 R. N. & H. C.—A. J. SMITH, Rendlesham, for Rendlesham Andree.

**Class 77.—Suffolk Mares (with Foals at foot).** [9 entries, 3 absent.]

- 645 I. (£15).—R. HOLMES WHITE, Boulge Hall, Woodbridge, for Nectar 4177, chestnut, foaled 1890 [foal by Golden Grain 2479], bred by S. Toller, Letheringham, Suffolk; s. Emperor 1611, d. Duchess 928 by Prince Imperial 1239.  
 646 II. (£10).—A. H. E. WOOD, Sudbourn Hall, Wickham Market, for Sudbourn Queen of Trumps 4330, chestnut, foaled 1889 [foal by Golden Grain 2479], bred by C. Austin, Brandeston, Wickham Market; s. Cupbearer 3rd 566, d. Queen of Diamonds 1859 by Vanguard 1327.  
 642 III. (£5).—SIR CUTHBERT QUILTER, BT., M.P., Bawdsey Manor, Woodbridge, for Court Pride 4108, chestnut, foaled 1895 [foal by Court Renown 2742], bred by H. Turner, Mickfield Hall, Stowmarket; s. Sudbourn Duke 2080, d. Blossom 2440 by Punch 898.  
 640 R. N. & H. C.—ROBERT EDGAR, for Hurricane.  
 641 Com.—SIR CUTHBERT QUILTER, BT., M.P., for Butley Lass.

**Class 78.—Suffolk Fillies, foaled in 1897.**

[6 entries, none absent.]

- 651 I. (£15).—A. H. E. WOOD, Sudbourn Hall, Wickham Market, for Sudbourn Queen of Diamonds 4348, chestnut, bred by the Trustees of the late Duke of Hamilton, Easton Park, Wickham Market; s. Eclipse 2627, d. Sudbourn Queen of Trumps 4330 by Cupbearer 3rd 566.  
 650 II. (£10).—EDWARD F. QUILTER, Hill House, Belstead, Ipswich, for Bentley Duchess 4129, chestnut, bred by S. Stanford, Laxfield, Framlingham; s. Border Minstrel 2287, d. Laxfield Diamond 1423 by Wantiden Duke 534.  
 649 III. (£5).—SIR CUTHBERT QUILTER, BT., M.P., Bawdsey Manor, Woodbridge, for Maud 4144, chestnut, bred by Pratt & Sons, Chillesford, Suffolk; s. Eclipse 2627, d. Lady Royal 3725 by Como 2385.  
 647 R. N. & H. C.—THE EARL OF DERBY, K.G., for Glimpee.  
 648 Com.—THE EARL OF DERBY, K.G., for Lady Arthur.

**Class 79.—Suffolk Fillies, foaled in 1898.** [11 entries, 1 absent.]

- 655 I. (£15).—SIR CUTHBERT QUILTER, BT., M.P., Bawdsey Manor, Woodbridge, for Bawdsey China Doll 4299, chestnut; s. Prince Wedgewood 2364, d. Bawdsey Dolly 3611 by Czar 1754.  
 654 II. (£10).—W. R. HUSTLER, Earls Hall, Cockfield, Bury St. Edmunds, for Rosa 4429, chestnut, bred by John Symonds, Thistleton Hall, Burgh, Woodbridge; s. Eclipse 2627, d. Ruth 3398 by Wedgewood 1749.  
 657 III. (£5).—EDWARD F. QUILTER, Hill House, Belstead, Ipswich, for Bentley Belle 4320, chestnut, bred by F. C. Le G. Starkie, Mitchells, Saffron Walden; s. Dr. Jim 2738, d. The Miller's Daughter 2608 by Sultan 1727.  
 663 R. N. & H. C.—A. H. E. WOOD, for Sudbourn Princess.  
 H. C.—A. J. SMITH, for No. 659, Rendlesham Merry; A. H. E. WOOD, for No. 662, Sudbourn Dream.  
 661 Com.—A. H. E. WOOD, for Sudbourn Bluebell,

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Draught Horses of any Breed (in harness).**

**Class 80.—Agricultural Geldings, foaled in 1896.<sup>1</sup>**

[7 entries, 2 absent.]

- 665 I. (£15).—PETER DAVIES, Midlands Farm, Warburton, Cheshire, for Midlands Rattler, bay, bred by H. A. Underwood, Muroott, Rugby; s. Catthorpe Diaraeli 18952.
- 664 II. (£10).—JAMES BROOKS, Trent House, Willington, Derbyshire, for Drayman, chestnut, bred by Mr. Hellaby, Bramcote; s. Sweptone King 13677.
- 670 III. (£5).—R. SILCOCK & SONS, Poulton-le-Fylde, Lancs. for bay, bred by T. H. Miller, Singleton Park, Poulton-le-Fylde; s. Morcar 13330, d. Macon 15172 by Mohammed 6173.
- 669 IV. (£3).—J. REAY, East Brunton, Gosforth, Northumberland, for Bixie, brown, bred by Mr. Atkinson, Wynard Park; s. Holyrood.
- 666 R. N. & H. C.—GEORGE KENDREW, Elm House, Northallerton, for Ben.

**Class 81.—Agricultural Geldings, foaled in 1897.<sup>1</sup>**

[12 entries, 2 absent.]

- 676 I. (£15).—TIMOTHY LOWE, The Oaklands, Walton, Burton-on-Trent, for Barrow Excelsior, chestnut, bred by Hayward Edwards, Pré Wood Farm, St. Albans; s. Harold Harefoot 13147, d. Patty 20583 by Extraordinary 7206.
- 672 II. (£10).—B. & J. DAVISON, Welham, Malton, for Birdsall Clansman, brown, bred by Lord Middleton, Birdsall House, York; s. Calamite 15037, d. Cloudy Morn 19646 by Coldstream 13961.
- 681 III. (£5).—SIR J. H. WALKER, BT., Home Farm, Sand Hutton, York, for Royal, bay; s. Ruddington Lord Chancellor 14259.
- 680 IV. (£3).—JOSEPH THEAKSTON, Little Onseburn, York, for Fashion, bay, bred by I. N. Woodiwiss, Duffield, Derby; s. British Flag 3rd 12841, d. Brooklands Lady 16305 by Carlton Stockwell 9069.
- 677 R. N. & H. C.—A. MANSELL, Crossrigg, Penrith, for King of Diamonds.
- 674 H. C.—JOHN HOLM, for Jelly.
- 682 Com.—W. M. WOOD, for The Boss.

**Class 82.—Agricultural Pairs.<sup>1</sup> [4 entries, 1 absent.]**

- 684 I. (£15).—JAMES EADIE, Barrow Hall, Derby, for Bardon Extraordinary, bay, foaled 1892, bred by W. T. Everard, Bardon Hall, Leicester; s. Extraordinary 7206, d. Bardon Lady Jane 13973 by Premier 2646; and Barrow Farmer, bay, foaled 1894, bred by late G. H. Spraggon, Nafferton, Stocksfield-on-Tyne; s. Luck 3837, d. Black Pride by Albert 2nd 5466.
- 683 II. (£10).—PETER DAVIES, Midlands Farm, Warburton, Cheshire, for Midlands Carbon and Midlands Banker, foaled 1895.
- 686 III. (£5).—W. M. WOOD, Purston Hall, Pontefract, Yorks, for Sailor, bay, foaled 1896, bred by Mr. Brown, Pasture House, Cumberland; s. Farmer's Profit; and Sherrie, brown, foaled 1896, bred by Mr. Nichol, Abbey Town, Cumberland; s. Forest Hero.

**Class 83.—Railway or Corporation Horses.<sup>1</sup> [3 entries, 1 absent.]**

- 687 I. (£10).—J. W. POLLITT, Great Central Railway, Ashton-under-Lyne, for Bowler, bay, foaled 1893.
- 688 II. (£5).—J. W. POLLITT, for Thumper, bay, foaled 1894.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 84.—*Tradesmen's Heavy or Rulley Horses.*<sup>1</sup> [6 entries.]**

- 692 I. (£10.)—T. H. SOWDEN, Albany House, Clifton, York, for *Intake Fashion* 20135, bay, foaled 1892, bred by W. Milner, Inskip, Preston; s. Mohammed 6173, d. Bet by Adam 65.
- 694 II. (£5.)—T. H. SOWDEN, for *Orange Blossom* 26618, black, foaled 1896, bred by the Exors. of the late E. Charnock, Fazakerley, Liverpool; s. Harold 3703, d. Calceolaria 7720 by Bar None 2388.
- 695 III. (£3.)—T. H. SOWDEN, for *Silver Belle*, bay, foaled 1896, bred by Mr. Tomlinson, Preston, Hull; s. Silver King 4034, d. by Clan Ranald 6604.
- 691 IV. (£2.)—FRANK ROBSON, The Cedars, Sunderland, for *Reform*, black, foaled 1892.
- 690 B. N. & H. C.—JOHN J. HUNT, LTD., Ebor Brewery, York, for *Tom*.
- 693 H. C.—T. H. SOWDEN, for *Moors Orange Peel*.

**Class 85.—*Tradesmen's Light Horses.*<sup>1</sup> [1 entry.]**

- 696 I. (£10.)—GEORGE HOLMES, Acomb, York, for *Yorkshireman*, bay, foaled 1897; s. Yorkist, d. Kitty.

## CATTLE.

### Shorthorns.

**Class 86.—*Shorthorn Bulls, calved in 1896 or 1897.***

[17 entries, 2 absent.]

- 697 I. (£15.)—H.R.H. THE PRINCE OF WALES, K.G., Sandringham, for *Stephanos* 71688, roan, born Jan. 2, 1896, bred by H.M. the Queen, Windsor; s. Fairfax 60792, d. Seclusion by Gael 60855.
- 704 II. (£10.)—JOHN HANDLEY, Green Head, Milnthorpe, for *Lord James Douglas* 70828, roan, born Feb. 20, 1896, bred by C. E. Law, Holl Farm, Boharm, Keith, N.B.; s. Lord James 67361, d. Marigold 2nd by Star of Morning 58189.
- 709 III. (£5.)—THE DUKE OF NORTHUMBERLAND, K.G., Alnwick Castle, Northumberland, for *Highland Blizzard* 70618, white, born Nov. 17, 1896; s. Highland Snowstorm 62709, d. Daisy's Delight by St. Patrick 55011.
- 707 B. N. & H. C.—J. MIDGLEY, Buttercrambe, Stamford Bridge, for *Marvel*.
- 713 H. C.—JONAS WEBB, for *Carlisle Wellington*.  
Com.—J. E. CASSWELL, for No. 699, *Laughton Victor*; HENRY DUDDING, for No. 702, *Prompter*; T. THOMPSON, for No. 711, *Royal Boy*.

**Class 87.—*Shorthorn Bulls, calved in 1898.* [34 entries, 9 absent.]**

- 714 I. (£15, & Champion.<sup>2</sup>)—H.M. THE QUEEN, The Prince Consort's Shaw Farm, Windsor, for *Royal Duke* 75509, roan, born March 17; s. Prince Victor 73320, d. Rosewater by Red Rover 63192.
- 716 II. (£10, & B. N. for Champion.<sup>2</sup>)—H.R.H. THE PRINCE OF WALES, K.G., Sandringham, for *Pride of Collynie* 75248, roan, born Feb. 23, bred by W. Duthie, Collynie, Farves, N.B.; s. Pride of Morning 64546, d. Lady Lancaster 8th by Dauntless.
- 715 III. (£5.)—H.R.H. THE PRINCE OF WALES, K.G., Sandringham, for *Crystal Quality* 74829, roan, born July 11; s. Crystal Prince 70221, d. Rare Quality by Sharp-shooter 55034.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Prize of £20, given by the Shorthorn Society of Great Britain and Ireland for the best Shorthorn Bull exhibited in Classes 86-88.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 719 **B. N. & H. C.**—MISS ALICE DE ROTHSCHILD, for *Bashful Youth*.  
**H. C.**—J. W. BARNES, for No. 717, *Dauntless*: GEORGE HARRISON, for No. 729, *Favourite of Sanguhar*; WM. HENDERSON, for No. 731, *Elington Stamp*.  
**Com.**—W. H. FRANK, for No. 726, *Welcome Captain*; D. A. GREEN, for No. 728, *Lavender Yet*: PHILO L. MILLS, for No. 737, *St. Swithin*; ROBERT TAYLOR, for No. 744, *His Grace*.

**Class 88.—Shorthorn Bulls, calved in 1899.** [40 entries, 11 absent.]

- 776 **I. (£15).**—THE DUKE OF NORTHUMBERLAND, K.G., Alnwick Castle, Northumberland, for *Royal Norseman*, roan, born Jan. 8; s. Norse King 69186, d. Cherry Queen (vol. xlv. p. 635) by Beau Ben 60350.  
 770 **II. (£10).**—W. J. HOSKEN, Loggans Mill, Hayle, Cornwall, for *New Year's Gift*, roan, born Jan. 1; s. Treforest 63452, d. Countess of Oxford 14th (vol. xli. p. 431) by Fireball 64025.  
 782 **III. (£5).**—LORD TREDEGAR, Tredegar Park, Newport, Mon., for *Prince Alto*, white, born Feb. 3; s. Alto 68147, d. Rose of Tredegar (vol. xliii. p. 731) by Comet 4th 62313.  
 760 **B. N. & H. C.**—HENRY DUDDING, Riby Grove, Gt. Grimsby, for *King Alto*.  
**H. C.**—WM. BELL, for No. 755, *Baron Abbotsford*; GEORGE HARRISON, for No. 763, *Gainford First Favourite* and No. 765, *Gay Knight*; J. W. HARRISON, for No. 766, *Morning Crown*.  
**Com.**—T. ADAMSON, for No. 749, *Dunottar's Style*; T. ATKINSON, for No. 750, *Baron Bridekirk 26th*; J. W. BARNES, for No. 754, *Cumberland Star*.

**Class 89.—Shorthorn Cows (in-milk or in-calf), calved in 1894, 1895, or 1896.** [16 entries, 2 absent.]

- 799 **I. (£15, & Champion.<sup>1</sup>)**—W. J. HOSKEN, Loggans Mill, Hayle, Cornwall, for *Countess of Oxford 14th* (vol. xli. p. 431), red, born Aug. 10, 1894, in-milk, calved April 27, 1900; s. Fireball 64025, d. Countess of Oxford 13th by Duke of Tregunter 10th 54224.  
 801 **II. (£10).**—D. H. MYTTON, Garth, Welshpool, for *Silene* (vol. xliii. p. 597), roan, born May 23, 1896, in-milk, calved Jan. 3, 1900; s. Fairy King 65479, d. Sybil by Nine of Diamonds 61363.  
 788 **III. (£5).**—WILLIAM BELL, Ratcheugh, Alnwick, for *Lady Clara 3rd*, roan, born March 16, 1896, in-milk, calved Jan. 16, 1900, bred by W. Duthie, Collynie, Tarves; s. Abbotsford 66588, d. Cinderella (vol. xxxix. p. 343) by Lord Lavender 54616.  
 802 **B. N. & H. C.**—LORD POLWARTH, for *Lady Beatrice*.  
**H. C.**—C. W. BRERLEY, for No. 789, *Autumn Queen*; VICTOR C. W. CAVENDISH, M.P., for No. 792, *Lady Albreda*; MISS ALICE DE ROTHSCHILD, for No. 793, *Brucetor Queen*; GEORGE HARRISON, for No. 798, *Welcome*.  
**Com.**—LEOPOLD DE ROTHSCHILD, for No. 795, *Mayflower 3rd*; J. J. MOUBRAY, for No. 800, *Dame Honoria Riby*.

**Class 90.—Shorthorn Heifers (in-milk or in-calf), calved in 1897.** [11 entries, 3 absent.]

- 807 **I. (£15, & B. N. for Champion.<sup>1</sup>)**—JOSEPH HARRIS, Calthwaite Hall, Carlisle, for *Empress 12th* (vol. xlv. p. 455), red, born May 19, in-milk, calved Feb. 8, 1900; s. Oxford Duke of Calthwaite 30th 69211, d. Empress 10th by Cumbrian Butterfly 58715.

<sup>1</sup> Champion Prize of £20, given by the Shorthorn Society of Great Britain and Ireland for the best Shorthorn Cow or Heifer exhibited in Classes 89-92.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 808 II. (£10.)—WILLIAM HEATON, Thorneyholme, Lostock, Bolton, for *Daisy 4th* (vol. xlv. p. 318), roan, born Jan. 1, in-milk, calved Oct. 27, 1899, bred by J. W. Barnes, Aikbank, Wigton; s. *Prince Victor* 69321, d. *Daisy* by *Crown Prince* 60564.
- 806 III. (£5.)—CAPT. W. H. O. DUNCOMBE, Waresley Park, Sandy, for *Warrior Queen* (vol. xlv. p. 480), roan, born June 13, in-milk, calved Oct. 23, 1899; s. *Liberator* 64260, d. *Amazon* by *Commander* 54116.
- 814 R. N. & H. C.—R. A. YERBURGH, M.P., for *Morning Belle*.
- 804 H. C.—LEOPOLD DE ROTHSCHILD, for *White Socks*.
- 812 Com.—LORD POLWARTH, for *Cowslip Blossom*.

**Class 91.—Shorthorn Heifers, calved in 1898. [19 entries, 4 absent.]**

- 815 I. (£15.)—H. M. THE QUEEN, The Prince Consort's Shaw Farm, Windsor, for *Rose of Sharon* (vol. xlv. p. 276), roan, born April 4; s. *Prince Victor* 73320, d. *Rose of Scotland* by *Scottish Archer* 59893.
- 827 II. (£10.)—JOSEPH HARRIS, Calthwaite Hall, Carlisle, for *Pansy 2nd*, roan, born March 2, bred by J. W. Barnes, Aikbank, Wigton; s. *Valasco* 71756, d. *Pansy* (vol. xlv. p. 306) by *Pearl Prince* 61427.
- 821 III. (£5.)—HENRY DUDDING, Riby Grove, Gt. Grimsby, for *Lady 21st*, roan, born April 18, bred by C. M. Cameron, Balnakyle, N.B.; s. *Idol* 68791, d. *Lady 7th* (vol. xl. p. 306) by *Merlin* 54715.
- 826 R. N. & H. C.—R. & W. T. GARNE, Northleach, for *Aldsworth Jewel*.
- 820 H. C.—HENRY DUDDING, for *Favourite Lily*.  
Com.—VICTOR C. W. CAVENDISH, M.P., for No. 817, *Holker Countess* *Burlington 2nd*; GEORGE HARRISON, for No. 828, *Welfare*.

**Class 92.—Shorthorn Heifers, calved in 1899. [25 entries, 5 absent.]**

- 855 I. (£15.)—LORD TREDEGAR, Tredegar Park, Newport, Mon., for *Lassie 3rd*, roan, born Jan. 3; s. *Regent* 71351, d. *Lassie 2nd* (vol. xliii. p. 731) by *Rodney* 67757.
- 847 II. (£10.)—LORD MIDDLETON, Birdsall House, York, for *Lady Waterloo B 2nd*, roan, born Jan. 28, bred by C. M. Cameron, Balnakyle, Munloch, N.B.; s. *Merry Merlin* 73068, d. *Lady Waterloo B* (vol. xlv. p. 568) by *Lord Ross* 72918.
- 840 III. (£5.)—CAPT. W. H. O. DUNCOMBE, Waresley Park, Sandy, for *Baby Robe*, roan, born June 15; s. *Freeman* 74583, d. *Red Robe* by *Liberator* 64260.
- 835 R. N. & H. C.—WILLIAM ATKINSON, for *Hawthorn Gem 3rd*.  
H. C.—H. M. THE QUEEN, for No. 834, *Maritana*; L. DE ROTHSCHILD, for No. 838; G. H. PROCTER, for No. 852, *Fairy Ring*.  
Com.—HENRY DUDDING, for No. 839, *Lady 24th*; GEORGE HARRISON, for No. 842, *Village Queen*; JAMES LAWSON, for No. 846, *Rose of Wesham*; ROBERT TAYLOR, for No. 854, *Princess of Pitlivie 2nd*; R. A. YERBURGH, M.P., for No. 858, *Woodfold Rosebud*.

## Herefords.

**Class 93.—Hereford Bulls, calved in 1896 or 1897. [2 entries.]**

- 860 I. (£15.)—SIR J. PULLEY, BT., Lower Eaton, Herefordshire, for *Protector* 19680, born Jan. 22, 1897, bred by A. E. Hughes, Wintercott, Leominster; s. *Albion* 15027, d. *Newton Plum* by *Rudolph* 6660.
- 859 II. (£10.)—EDWARD FARR, Court of Noke, Pembridge, for *Britisher* 19261, born April 29, 1897, bred by A. E. Hughes, Wintercott, Leominster; s. *Albion* 15027, d. *Plum 4th* by *Cheerful* 6351.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 94.—Hereford Bulls, calved in 1898. [10 entries.]**

- 870 I. (£15.)—H. W. TAYLOR, Showle Court, Ledbury, for *Screaser* 20339, born Feb. 23, bred by A. P. Turner, The Leen, Pembridge; s. *Clarence* 15944, d. *Speedwell* by *Statesman* 14938.
- 862 II. (£10.)—THE EARL OF COVENTRY, Croome Court, Severn Stoke, Worcester, for *Mercury* 20192, born March 17; s. *Viscount* 18648, d. *Minerva* 2nd by *Good Boy* 7668.
- 868 III. (£5.)—RICHARD GREEN, The Whittern, Kington, Herefordshire, for *Whittern Sovereign*, born Jan. 11; s. *Diplomat* 18328, d. *Sylvania* (vcl. xxvi. p. 358) by *Pioneer* 16269.
- 864 E. N. & H. O.—LT.-COL. EVERARD, for *All Ireland*.  
H. C.—A. R. FIRKINS, for No. 865, *Lurdan*; RICHARD GREEN, for No. 866, *Privateer*.  
Com.—THE EARL OF COVENTRY, for No. 861, *Grimm*; J. EDWARDS, for No. 863, *Landseer*; RICHARD GREEN, for No. 867, *Silver King*; CAPT. HENYGATE, for No. 869, *Armour Plate*.

**Class 95.—Hereford Bulls, calved in 1899. [23 entries, 6 absent.]**

- 881 I. (£15.)—ALLEN E. HUGHES, Wintercrott, Leominster, for *Lemster*, born Feb. 14; s. *Albion* 15027, d. *Lofty* 2nd (vol. xxviii. p. 435) by *Seabreeze* 14153.
- 890 II. (£10.)—ARTHUR P. TURNER, The Leen, Pembridge, for *Mortimer*, born Feb. 3; s. *Clarence* 15944, d. *Melody* 2nd (vol. xxviii. p. 709) by *Statesman* 14938.
- 871 III. (£5.)—W. T. BARNEBY, Saltmarshe Castle, Bromyard, for *Gambler*, born Jan. 23; s. *Happy Hampton* 16097, d. *Gamester Lady* (vol. xxviii. p. 188) by *Horace Bonnor* 18138.
- 883 E. N. & H. O.—LAWTON MOORE, Brampton Brian, for *Glencee*.  
H. C.—THOMAS FENN, for No. 877, *Downton Beau*; A. E. HILL, for No. 879, *Durban*, and No. 880, *Lord Tredegar*; WILLIAM TUDGE, for No. 889, *Gold Mine*.  
Com.—EDWARD FARR, for No. 876, *Kerseymer*; THOMAS FENN, for No. 878, *Mafeking*; LAWTON MOORE, for No. 884, *Veteran*; H. W. TAYLOR, for No. 886, *Glencee*; E. J. WYTHES, for No. 891, *Copped Hall Forager*.

**Class 96.—Hereford Cows (in-milk or in-calf), calved in 1894, 1895, or 1896.**

[No entry.]

**Class 97.—Hereford Heifers (in-milk or in-calf), calved in 1897.**

[3 entries, 1 absent.]

- 896 I. (£10.)—WILLIAM TUDGE, Leinthall, Ludlow, for *Leinthall Beauty* (vol. xxix. p. 612), born Jan. 11, in-milk, calved Dec. 4, 1899; s. *Rupert* 16366, d. *Barbara* by *Ancient Briton* 15034.
- 894 II. (£5.)—JOHN TUDGE, Duxmoor, Craven Arms, for *Bustle Maid* (vol. xxix. p. 611), born April 9, in-milk, calved March 2, 1900, bred by the late T. Myddleton, Llynaven, Aston-on-Clun; s. *Ploughboy* 17424, d. *Miss Nobleman* 21st by *Liberal Tom* 7085.

**Class 98.—Hereford Heifers, calved in 1898. [5 entries, 2 absent.]**

- 900 I. (£15.)—ALLEN E. HUGHES, Wintercrott, Leominster, for *Ladylike* 2nd (vol. xxx. p. 360), born Feb. 8; s. *Lavender* 18910, d. *Ladylike* by *Albion* 15027.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

899 II. (£10.)—RICHARD GREEN, The Whittern, Kingston, Herefordshire, for *Waterweed*, born Feb. 17; s. *Diplomat* 18328, d. *Westeria* (vol. xxviii. p. 372) by *Pioneer* 16269.

897 B. N. & H. C.—DAVID EVANS, Ffrwdgrech, Brecon, for *Friend* 2nd.

**Class 99.—Hereford Heifers, calved in 1899.** [13 entries, 1 absent.]

907 I. (£15.)—RICHARD GREEN, The Whittern, Kingston, Herefordshire, for *Ladysmith*, born Jan. 2; s. *Diplomat* 18328, d. *Lady Helen* (vol. xxviii. p. 369) by *Pioneer* 16269.

914 II. (£10.)—WILLIAM TUDGE, Leinthall, Ludlow, for *Peggy Primrose*, born Jan. 11; s. *Goldbox* 15339, d. *Primrose* (vol. xxv. p. 624) by *Bourton* 11005.

909 III. (£5.)—ALLEN E. HUGHES, Wintercott, Leominster, for *Myra*, born Feb. 10; s. *Albion* 15027, d. *Modesty* 4th (vol. xxviii. p. 435) by *Adonis* 10926.

904 B. N. & H. C.—W. T. BARNEBY, for *Delicacy*.

H. C.—H. M. THE QUEEN, for No. 902, *Sophie*; S. H. ARMITAGE, for No. 903, *Delta*.

Com.—W. T. BARNEBY, for No. 905, *Larkish*; LAWTON MOORE, for No. 910, *Brampton Agnes* 11th, and No. 911, *Brampton Sunflower* 9th; H. W. TAYLOR, for No. 913, *Violet Agnes*.

## Devons.

**Class 100.—Devon Bulls, calved in 1896, 1897, or 1898.**

[4 entries, none absent.]

916 I. (£15.)—THE HON. E. W. B. PORTMAN, Hestercombe, Taunton, for *Duke of Pound* 29th 3725, born Jan. 28, 1896, bred by A. C. Skinner, Pound Farm, Bishops Lydeard; s. *Masterpiece* 2837, d. *Duchess* 35th 13075 by *Lord Wolseley* 2063.

918 II. (£10.)—J. C. WILLIAMS, Caerhays Castle, St. Austell, for *Dramatist* 4015, born July 5, 1898; s. *Pretty Middling* 2859, d. *Ellen Terry* 3rd 12561 by *Marmaduke* 2280.

915 III. (£5.)—ALFRED BOWERMAN, Capton, Williton, Taunton, for *Sir Walter* 3959, born April 8, 1897; s. *Lord Culverhay* 3469, d. *Apricot* 13743 by *Palmerston* 2474.

**Class 101.—Devon Bulls, calved in 1899.** [2 entries.]

919 I. (£15.)—ALFRED BOWERMAN, Capton, Williton, Taunton, for *Bean Planter* 4139, born Jan. 3; s. *Harold* 4th 3595, d. *Modesty* 14974 by *Pretty Middling* 3rd 8173.

920 B. N. & H. C.—J. C. WILLIAMS, Caerhays Castle, St. Austell, for *Mica*.

**Class 102.—Devon Cows (in-milk or in-calf), calved in 1894, 1895, or 1896.** [5 entries, 1 absent.]

921 I. (£15.)—ALFRED BOWERMAN, Capton, Williton, Taunton, for *Sally* 15571, born Jan. 10, 1895, in-milk, calved Jan. 1, 1900; s. *Starlight* 3514, d. *Dolly* 5th 9482 by *Lord Ilbear* 1779.

925 II. (£10.)—J. C. WILLIAMS, Caerhays Castle, St. Austell, for *Molly* 5th 14885, born Feb. 13, 1895, in-milk, calved Nov. 5, 1899; s. *Captain* 2204, d. *Molly* 7986 by *Sir Watkin* 1846.

922 III. (£5.)—THE HON. E. W. B. PORTMAN, Hestercombe, Taunton, for *Handsome* 3rd 14865, born Jan. 1, 1894, in-milk, calved May 10, 1900, bred by J. Blackmore, Durston, Taunton; s. *Nobleman* 2848, d. *Handsome* 2nd 7497 by *Actor*.

924 B. N. & H. C.—J. C. WILLIAMS, for *Fickle*.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 103.—Devon Heifers (in-milk or in-calf), calved in 1897.**

[3 entries.]

- 928 I. (£15.)—E. J. STANLEY, M.P., Quantock Lodge, Bridgwater, for Quantock Daisy 2nd 15991, born March 27, calved Sept. 10, 1900; s. Tregothnan 2902, d. Daisy's Twin 1st 9091 by General Colley 1864.
- 927 II. (£10.)—THE HON. E. W. B. PORTMAN, Hestercombe, Taunton, for Tulip 10th of Pound 15961, born May 6, in-milk, calved May 15, 1900, bred by A. C. Skinner, Bishop's Lydeard, Taunton; s. Harold 4th 3595, d. Tulip 9th of Pound 13616 by Masterpiece 2837.
- 926 B. N. & H. C.—A. BOWERMAN, Capton, Williton, Taunton, for Hollybud.

**Class 104.—Devon Heifers, calved in 1898. [4 entries.]**

- 982 I. (£10.)—J. C. WILLIAMS, Caerhays Castle, St. Austell, for Waterhen 6th 16621, born Jan. 16; s. Cardsharper 3082, d. Waterhen 3rd 14299 by Doleful 2384.
- 929 II. (£5.)—ALFRED BOWERMAN, Capton, Williton, Taunton, for Capton Ladysmith 16693, born Jan. 3; s. Pretty Middling 3rd 3173, d. Lucy 13766 by Starlight 3514.
- 980 B. N. & H. C.—THE HON. E. W. B. PORTMAN, for Hestercombe Princess.
- 931 Com.—E. J. STANLEY, M.P., for Quantock Princess 8th.

**Class 105.—Devon Heifers, calved in 1899.**

[5 entries, 1 absent.]

- 933 I. (£10.)—H.M. THE QUEEN, Flemish Farm, Windsor, for Gem 16638, born Feb. 4; s. Dauntless 3864, d. Good Luck 3rd 12797 by Duke of Wellington 1955.
- 936 II. (£5.)—THE HON. E. W. B. PORTMAN, Hestercombe, Taunton for Hestercombe Roseleaf 17049, born May 4; s. Lord Passmore 9th 3917, d. Roseleaf of Pound 15344 by Duke of Currypool 3096.
- 934 B. N. & H. C.—BOVINE, LD., for Bovine Princess.
- 937 H. C.—E. J. STANLEY, M.P., for Quantock Beauty 16th.

**Sussex.**

**Class 106.—Sussex Bulls, calved in 1896, 1897, or 1898.**

[6 entries, none absent.]

- 943 I. (£15.)—PHILIP SAILLARD, Buchan Hill, Crawley, Sussex, for Alfred 1637, born April 13, 1896, bred by J. H. T. Broadwood, Lyne, Horsham; s. Vickress 1864, d. Curly 3rd 6481 by Hardy Boy 2nd 686.
- 939 II. (£10.)—THE EARL OF DERBY, K.G., Birtley, Witley, Godalming, for Diploma 1540, born Jan. 13, 1897; s. Proud Prince 1249, d. Diadem 6178 by Gladiator 1171.
- 940 III. (£5.)—THE EARL OF DERBY, K.G., Birtley, for Hero 1615, born July 29, 1898; s. Proud Prince 1249, d. Noblesse 8078 by Drungewick 456.
- 942 B. N. & H. C.—PHILIP SAILLARD, Crawley, for Aldon 3rd.
- 938 Com.—F. S. W. CORNWALLIS, M.P., for Lord Linton.

**Class 107.—Sussex Bulls, calved in 1899.**

[5 entries, 1 absent.]

- 944 I. (£15.)—THE EARL OF DERBY, K.G., Birtley, Witley, Godalming, for Buxom Baron 1681, born Feb. 28; s. Diploma 1540, d. Buxom Baroness 6771 by Proud Prince 1249.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 946 II. (£10.)—PHILIP SAILLARD, Buchan Hill, Crawley, for *Bewbush Marquis* 1720, born March 14; *s.* *Bewbush King* 1575, *d.* *Galatea* 5th 6931 *by* *What's Wanted* 1329.
- 947 B. N.—GERALD WARDE, West Farleigh, Maidstone, for *Tutsham Rival*.

**Class 108.—Sussex Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897. [3 entries.]**

- 949 I. (£15.)—THE EARL OF DERBY, K.G., Birtley, Witley, Godalming, for *Minx* 6502, born May 9, 1894, in-milk, calved Aug. 3, 1899; *s.* *Lord Oxeye* of *Wantly* 1070, *d.* *Mirthful* 4691 *by* *Buffer* 663.
- 951 II. (£10.)—GERALD WARDE, Tutsham Hall, West Farleigh, Maidstone, for *Tutsham Marguerite* 7202, born April 24, 1896, in-milk, calved May 31, 1900, bred by C. J. Lucas, Warnham Court, Horsham; *s.* *Lord Oxeye* 2nd 1383, *d.* *Linnet* 5868 *by* *Gondolier* 1001.
- 950 B. N. & H. C.—PHILIP SAILLARD, Buchan Hill, Crawley, for *Maud* 2nd.

**Class 109.—Sussex Heifers, calved in 1898. [3 entries, 1 absent.]**

- 952 I. (£10.)—MAJOR BEST, Park House, Boxley, Maidstone, for *Grace Darling* 7558, born Feb. 6; *s.* *Churchill* 1373, *d.* *Grandiflora* 4627 *by* *Frankfort* 1st 811.
- 953 II. (£5.)—THE EARL OF DERBY, K.G., Birtley, Witley, Godalming, for *Melody* 7595, born Jan. 26; *s.* *Golden Rex* 1903, *d.* *Modesty* 6775 *by* *Proud Prince* 1249.

**Class 110.—Sussex Heifers, calved in 1899. [8 entries, 5 absent.]**

- 960 I. (£10.)—GERALD WARDE, Tutsham Hall, West Farleigh, Maidstone, for *Tutsham Marguerite* 2nd, born Feb. 5; *s.* *Headley* 1201, *d.* *Tutsham Marguerite* 7202 *by* *Lord Oxeye* 2nd 1383.
- 955 II. (£5.)—MAJOR BEST, Park House, Boxley, Maidstone, for *Buckthorn* 7881, born Jan. 4; *s.* *Boxley Napier* 1526, *d.* *Buxom* 5769 *by* *Gondolier* 1001.
- 959 B. N. & H. C.—PHILIP SAILLARD, Crawley, for *Bewbush Princess*.

## Longhorns.

**Class 111.—Longhorn Bulls, calved in 1896 or 1897. [2 entries.]**

- 964 I. (£10.)—H. JASPER SELWYN, Little Woodcote, Kenilworth, for *Wootton Wonder*, dark brindle, born Jan. 30, 1897; *s.* *Pretender* 2nd, *d.* *Pink* *by* *Baddesley*.
- 963 B. N. & H. C.—THE HON. E. A. FITZROY, for *Prince Charlie*.

**Class 112.—Longhorn Cows or Heifers, in-milk or in-calf, calved in 1894, 1895, 1896, or 1897. [6 entries.]**

- 967 I. (£10.)—W. H. SALE, Arden Hill, Atherstone, for *Barton Sunshine*, red and white, born Dec. 26, 1896, in-milk, calved Oct. 21, 1899, and in-calf, bred by H. Houghton, Narley House, Osbaston, Nuneaton; *s.* *Warwickshire Lad* 369, *d.* *Ladylike* *by* *Fradley Prior* 312.
- 965 II. (£5.)—THE HON. E. A. FITZROY, Fox Hill, West Haddon, Rugby, for *Angelica*, dark brindle and white, born Dec. 12, 1896, in-milk, calved Dec. 2, 1899; *s.* *Restless William* 346, *d.* *Venus* *by* *Kenilworth* 316.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 966 **R. N. & H. C.**—THE HON. E. A. FITZ ROY, West Haddon, for *Rose*.  
**Com.**—W. H. SALE, for No. 968, *Primrose*; H. JASPER SELWYN, for No. 969, *Bob Tail*, and No. 970, *Melcombe Queen*.

## Welsh.

### Class 113.—*Welsh Bulls, calved in 1896, 1897, or 1898.* [4 entries.]

- 971 **I. (£15.)**—R. M. GREAVES, Wern, Portmadoc, N. Wales, for *Madoc Boy* 398, born June 24, 1897; *s.* *Madoc Lad* 311, *d.* *Royal Windsor* 2nd by *William Pennant* 264.  
 974 **II. (£10.)**—COL. HENRY PLATT, C.B., Gorrddinog, Llanfairfechan, N. Wales, for *Plas Caradog* 412, born Feb. 5, 1898, bred by R. W. Pritchard, Coed Marian, Carnarvon; *s.* *Windsor* 362, *d.* *Eiren Ddu* 1043 by *Llety* 272.  
 972 **R. N. & H. C.**—LORD HARLECH, Glyn, Talsarnau, for *Dreyfus*.  
 973 **Com.**—LORD HARLECH, for *Sylfaen*.

### Class 114.—*Welsh Bulls, calved in 1899.* [6 entries, 1 absent.]

- 979 **I. (£15.)**—COL. HENRY PLATT, C.B., Gorrddinog, Llanfairfechan, N. Wales, for *Madryn Berw*, born Jan. 3, bred by H. Ellis, Tairmeibion, Bangor; *s.* *Hyfwr*, *d.* *Blodeuwedd* 864 by *Berw*.  
 975 **II. (£10.)**—R. M. GREAVES, Wern, Portmadoc, N. Wales, for *Kopje*, born Jan. 10, bred by R. Roberts, Bronygadair, Portmadoc; *s.* *Snowdon Bach* 413, *d.* *Ynys by Bounce* 308.  
 977 **R. N. & H. C.**—LORD HARLECH, Glyn, Talsarnau, for *Ensign*.  
 976 **Com.**—LORD HARLECH, for *Crusher*.

### Class 115.—*Welsh Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897.* [5 entries, none absent.]

- 985 **I. (£15.)**—COL. HENRY PLATT, C.B., Gorrddinog, Llanfairfechan, for *Queen of Spades* 2nd<sup>1</sup> 1034, born Feb. 19, 1895, in-calf; *s.* *The Alderman* 358, *d.* *Queen of Spades* 1033.  
 981 **II. (£10.)**—R. M. GREAVES, Wern, Portmadoc, for *Tremadoc*<sup>1</sup> 1135, born Jan. 3, 1897, in-calf; *s.* *Madoc Lad* 311, *d.* *Treffys*.  
 984 **R. N. & H. C.**—W. E. OAKELEY, The Plas, Tan-y-Bwlch, for *Twillla*.  
 982 **Com.**—LORD HARLECH, for *Tulip* 4th.

### Class 116.—*Welsh Heifers, calved in 1898.* [4 entries.]

- 986 **I. (£10.)**—R. M. GREAVES, Wern, Portmadoc, for *Brynywern*, born Jan. 7; *s.* *Bryntwr* 395, *d.* *Gairregback* by *Brenin Morfa* 233.  
 987 **II. (£5.)**—W. E. OAKELEY, The Plas, Tan-y-Bwlch, for *Pyrites* 2nd 1190, born Jan. 3; *s.* *Hwfa* 420, *d.* *Pyrites* 973 by *Arduwly* 255.  
 989 **R. N. & H. C.**—COL. HENRY PLATT, C.B., for *Madryn Queen*.  
 988 **Com.**—COL. HENRY PLATT, C.B., for *Madryn Belle*.

### Class 117.—*Welsh Heifers, calved in 1899.* [4 entries.]

- 991 **I. (£10.)**—W. E. OAKELEY, The Plas, Tan-y-Bwlch, for *Llywyn*, born Jan. 2; *s.* *Hwfa* 420, *d.* *Pyrites* 973 by *Arduwly* 255.  
 993 **II. (£5.)**—COL. HENRY PLATT, C.B., Gorrddinog, Llanfairfechan, for *Traffol* 3rd, born Jan. 27; *s.* *Madoc Lad* 311, *d.* *Traffol* 920 by *Roderick* 246.  
 990 **R. N. & H. C.**—R. M. GREAVES, Wern, Portmadoc, for *Drift*.  
 992 **Com.**—W. E. OAKELEY, for *Weidr*.

<sup>1</sup> Subject to compliance with Regulation as to calving.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## Red Polled.

### Class 118.—Red Polled Bulls, calved in 1896, 1897, or 1898.

[7 entries, 1 absent.]

- 999 I. (£15, & Champion.)—JAMES E. PLATT, Howbury Hall, Bedford, for Champion 5370, born Jan. 1, 1897, bred by Garrett Taylor, Trowse House, Norwich; s. Red Prince 2902, d. Coronet 2nd 5367 by Iago 1025.
- 994 II. (£10, & B. N. for Champion.)—LORD AMHERST OF HACKNEY, Didlington Hall, Brandon, for Redvers 6570, born March 12, 1898, bred by late J. J. Colman, Carrow House, Norwich; s. Rosy Boy 4627, d. Telba 8251 by Game Boy 2315.
- 997 III. (£5.)—R. HARVEY MASON, Necton Hall, Swaffham, for Magician 5021, born June 8, 1896; s. Majiolini 3600, d. Memphis 9562 by Paris 1974.
- 1000 B. N. & H. C.—JAMES E. PLATT, for Red Knight.

### Class 119.—Red Polled Bulls, calved in 1899.

[8 entries, 4 absent.]

- 1008 I. (£15.)—A. J. SMITH, Rendlesham, Woodbridge, for Eyke Don, born March 17; s. Russett's Delight 4641, d. Donna Barbara 10176 by Playford Comedy 3649.
- 1001 II. (£10.)—H. R. H. THE DUKE OF YORK, K.G., Sandringham, for Field Ranger, born Jan. 2; s. Ranger 5128, d. Midnight 7314 by Davyson 42nd 1776.
- 1003 B. N. & H. C.—J. B. DIMMOCK, for Shetford Best Man.
- 1004 H. C.—R. HARVEY MASON, for Defiance.

### Class 120.—Red Polled Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897. [7 entries, 1 absent.]

- 1009 I. (£15, & Champion.)—LORD AMHERST OF HACKNEY, Didlington Hall, Brandon, for Charmante 10080, born June 9, 1895, in-milk, calved April 19, 1900; s. Caister Spark 3413, d. Charm 2nd 7739 by Didlington Davyson 2nd 657.
- 1013 II. (£10.)—JAMES E. PLATT, Howbury Hall, Bedford, for Bruna 12080, born March 29, 1897, in-milk, calved Jan. 19, 1900, bred by the late J. J. Colman, Carrow House, Norwich; s. Ruby Prince 4131, d. Brinhilda 8377 by Jupiter 2380.
- 1010 III. (£5.)—LORD AMHERST OF HACKNEY, Didlington Hall, for Jubilee Emblem 12483, born June 21, 1897, in-milk, calved Jan. 26, 1900; s. Caister Spark 3413, d. Elaine 9297 by Red Shirt 2014.
- 1014 B. N. & H. C.—JAMES E. PLATT, for Dorylass.

### Class 121.—Red Polled Heifers, calved in 1898.

[6 entries, none absent.]

- 1020 I. (£10, & B. N. for Champion.)—JAMES E. PLATT, Howbury Hall, Bedford, for Red Lass 14121, born Jan 23, bred by late J. J. Colman, Carrow House, Norwich; s. Rosy Boy 4627, d. Red Top 8911 by Red Prince 2902.
- 1019 II. (£5.)—JAMES E. PLATT, for Dermouse 13419, born April 22, bred by the late J. J. Colman, Carrow House, Norwich; s. Redmond 5147, d. Dorena 6308 by Iago 1025.

<sup>1</sup> Champion Prize of £10 given by the Red Polled Society for the best Red Polled Bull exhibited in Classes 118 and 119.

<sup>2</sup> Champion Prize of £10 given by the Red Polled Society for the best Red Polled Cow or Heifer exhibited in Classes 120-122.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1016 **R. N. & H. C.**—**LORD AMHERST OF HACKNEY**, for *Didlington Davy 11th*.  
**Com.**—**F. J. METHOLD**, for No. 1017, *Davy Lass*, and No. 1018, *Handsome Davy*.

**Class 122.—Red Polled Heifers, calved in 1899.**

[6 entries, 1 absent.]

- 1026 **I. (£10.)**—**JAMES E. PLATT**, Howbury Hall, Bedford, for *Tiara*, born Jan. 31, bred by the late J. J. Colman, Carrow House, Norwich; *s. Champion 5370, d. Necklace 11610 by Red Prince 2902*.  
 1027 **II. (£5.)**—**A. J. SMITH**, Rendlesham, Woodbridge, for *Eyke Dairymaid*, born Feb. 10; *s. The Dairyman 6109, d. Kinswoman 7965 by Randolph*.  
 1025 **R. N. & H. C.**—**JAMES E. PLATT**, for *Miss Poppy 3rd*.  
 1022 **H. C.**—**LORD AMHERST OF HACKNEY**, for *Popsey 5th*.  
 1023 **Com.**—**E. LYCETT GREEN**, for *Tealeaf*.

**Aberdeen Angus.**

**Class 123.—Aberdeen Angus Bulls, calved in 1896, 1897, or 1898.**

[13 entries, 4 absent.]

- 1028 **I. (£15, & Champion.<sup>1</sup>)**—**W. S. ADAMSON**, Careston Castle, Forfarshire, for *Dias 14272*, born Dec. 24, 1896, bred by Patrick Chalmers, Aldbar Castle, Brechin; *s. Enthusiast of Ballindalloch 8289, d. Pride of Burnshangie 21047 by Pilchard 7827*.  
 1035 **II. (£10, & R. N. for Champion.<sup>1</sup>)**—**ALEXANDER McLAREN**, Auchnaguie, Tullymet, Ballinluig, for *Delamere 13305*, born Jan. 15, 1896, bred by P. Chalmers, Aldbar Castle, Brechin; *s. Enthusiast of Ballindalloch 8289, d. Pride of Burnshangie 21047 by Pilchard 7827*.  
 1037 **III. (£5.)**—**C. W. DYSON PERRINS**, Ardross Castle, Alness, Ross-shire, for *Rosador*, born Dec. 11, 1897, bred by Sir G. Macpherson Grant, Bt., The Castle, Ballindalloch; *s. Edmeston 12445, d. Meadow Rose of Ballindalloch 20569 by Enthusiast of Ballindalloch 8289*.  
 1029 **R. N. & H. C.**—**T. H. BAINBRIDGE**, Eshott Hall, Felton, for *Annesley*.  
 1036 **Com.**—**SIR J. B. MAPLE, Bt., M.P.**, for *Lamplighter of Southgate*.

**Class 124.—Aberdeen Angus Bulls, calved in 1899.**

[8 entries, 3 absent.]

- 1042 **I. (£15.)**—**SIR JAMES DUKE, Bt.**, Laughton, Shortgate, R.S.O., Sussex, for *Satisfaction 17259*, born Jan. 9; *s. Junic 14535, d. Laughton Sally 2nd 23998 by Jolly Rover 7633*.  
 1041 **II. (£10.)**—**SIR JAMES DUKE, Bt.**, Shortgate, for *Rufus of Laughton 17284*, born Jan. 30; *s. Jolly Rover 7633, d. False Ruth 24921 by Rab of Commieston A. 11230*.  
 1043 **III. (£5.)**—**L. A. MACPHERSON**, Wyrley Grove, Pelsall, Staffs, for *Dier 16455*, born Jan. 3; *s. Dictator of Haddo 11583, d. Lady 2nd of the Aird 16471 by Ixion 5431*.  
 1048 **R. N.**—**GEO. WILDER**, Stansted Park, Emsworth, for *Venison*.

**Class 125.—Aberdeen Angus Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897. [11 entries, 3 absent.]**

- 1058 **I. (£15.)**—**CLEMENT STEPHENSON**, Sandyford Villa, Newcastle-on-Tyne, for *Elite of Benton 24772*, born May 2, 1896, in-milk, calved Feb. 7, 1900; *s. Albion 6525, d. Elissanna 17197 by Souter Johnny 1615*.

<sup>1</sup> Champion Gold Medal, given by the Polled Cattle Society for the best Aberdeen Angus animal exhibited in Classes 123-127.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1051 II. (£10.)—FRED CRISP, Stud Farm, New Southgate, for Lady May of Advie 25528, born Jan. 15, 1896, in-milk, calved Jan. 14, 1900, bred by John Grant, Advie Mains, Strathspey; s. Provost of Advie 11217, d. Lady Love of Advie 21846 by Rustler 8761.
- 1056 III. (£5.)—THOMAS SMITH, Powrie, Dundee, for Petalite<sup>1</sup> 22270, born April 17, 1894, in-calf, bred by Alex. Simpson, Kirkside, Banff; s. Eclipse of Guisachan 5993, d. Panoply 18438 by Pride of Morning 5641.
- 1057 R. W. & H. C.—THOMAS SMITH, Dundee, for Prunella of Powrie.
- 1052 H. C.—R. W. HUDSON, for Rhona of Ballindalloch.
- 1053 Com.—SIR J. B. MAPLE, BT., M.P., for Pride of Southgate.

**Class 126.—Aberdeen Angus Heifers, calved in 1898.**

[13 entries, 1 absent.]

- 1060 I. (£10.)—T. H. BAINBRIDGE, Eshott Hall, Felton, Northumberland, for Sabrina of Hayston 27744, born Jan. 17, bred by J. Whyte, Hayston, Glamis; s. Provost 2nd of Powrie 11219, d. Sonsie Lass 22505 by Jack's the Lad 9267.
- 1061 II. (£5.)—J. J. CRIDLAN, Home Farm, Maisemore Park, Gloucester, for Pride 13th of Kippendavie 27613, born Feb. 16, bred by Col. Stirling, Kippendavie; s. Norfolk 5th 7022, d. Pride of Kippendavie 14368 by El Moro 2714.
- 1062 R. W. & H. C.—R. W. HUDSON, Great Marlow, for Milady of Ruthven.
- H. C.—SIR J. B. MAPLE, BT., M.P., for No. 1067, Benefit 10th of Haynes; T. SMITH, for No. 1069, Withe of Ender 36th; C. STEPHENSON, for No. 1070, Jipsey of Benton 5th.
- Com.—THE DUKE OF LEEDS, for No. 1065, Marion of Benton; J. MCINTYRE, for No. 1066, Jipsey Queen of Theakston; THE EARL OF ROSEBERRY, K.G., for No. 1068, Abess 3rd of Kippendavie.

**Class 127.—Aberdeen Angus Heifers, calved in 1899.**

[18 entries, 3 absent.]

- 1089 I. (£10.)—THE EARL OF STRATHMORE, Glamis Castle, Forfarshire, for Bonnet of Glamis 29275, born Feb. 27; s. Fairy King of Kirkbridge 11662, d. Bandoline of Glamis 15713 by Alister 1939.
- 1090 II. (£5.)—THE EARL OF STRATHMORE, for Brunhilde 29276, born Feb. 21; s. Jolly Rover 7633, d. Battle 22820 by Jovial Souter 7634.
- 1078 R. W. & H. C.—A. J. DORMAN, for Judy of Nunthorpe.
- H. C.—C. E. HUNTER, for No. 1081, Joy of Selaby; J. MCINTYRE, for No. 1082, Jipsey Lass of Theakston; L. A. MACPHERSON, for No. 1084, Sweet Sunrise.
- Com.—THE REV. C. BOLDEN, for No. 1073, Panicle; R. W. HUDSON, for No. 1079, Effulgent of Danesfield.

**Galloways.**

**Class 128.—Galloway Bulls, calved in 1896, 1897, or 1898.**

[4 entries, none absent.]

- 1092 I. (£15.)—HENRY GRAHAM, Quarry Hill, Mealsgate, Cumberland, for Blackmoor 6622, born April 20, 1896, bred by W. Parkin-Moore, Whitehall, Mealsgate; s. Nonpareil of Castlemilk 6163, d. Nancy Lee 2nd 11992 by Scottish Borderer 669.

<sup>1</sup> Subject to compliance with Regulation as to calving.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1094 II. (£10).—ROBERT WILSON, Kilquhanity Farm, Dalbeattie, for *Macedougall* 4th of Tarbreoch 6841, born Feb. 15, 1897, bred by James Cunningham, Tarbreoch, Dalbeattie; *s.* Scottish Standard 6488, *d.* Maggie of Tarbreoch 8613 by Scottish Borderer 669.
- 1098 R. N. & H. C.—R. JEFFERSON, Rotheryke, Egremont, for Jubilee Gift.

**Class 129.—Galloway Bulls, calved in 1899.** [4 entries.]

- 1095 I. (£15).—DAVID BROWN, Lower Stepford, Holywood, Auldgirth, for *Campfollower* of Stepford 7476, born Feb. 28; *s.* Black Prince of Durham Hill 6846, *d.* Edie of Durham Hill 14926 by Contender of Tarbreoch 5994.
- 1096 II. (£10).—HENRY GRAHAM, Quarry Hill, Mealsgate, Cumberland, for *The Scot* 7461, born Jan. 5; *s.* Blackamoor 6622, *d.* Lady Sproat of White Hall 14848 by Nonpareil of Castlemilk 6163.
- 1097 III. (£5).—ROBERT JEFFERSON, Rotheryke, Egremont, Cumberland, for Contender 7497, born Jan. 13, bred by Mrs. Clark, Auchenhay, Castle Douglas; *s.* Sultan 6981, *d.* Clara of Auchenhay by Wanderer 4967.
- 1098 R. N. & H. C.—WM. PARKIN-MOORE, Whitehall, Mealsgate, for Bobs.

**Class 130.—Galloway Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897.** [5 entries.]

- 1100 I. (£15).—ROBERT JEFFERSON, Rotheryke, Egremont, Cumberland, for *Lady Nancy* 4th of Castlemilk<sup>1</sup> 13870, born March 19, 1894, in-calf, bred by Sir R. Jardine, Bt., Castlemilk; *s.* Black Douglas of Castlemilk 5002, *d.* Lady Nancy of Castlemilk 10261 by Rosebery of Castlemilk 1679.
- 1103 II. (£10).—ROBERT WILSON, Kilquhanity Farm, Dalbeattie, for *Maggie* 10th of Tarbreoch<sup>1</sup> 14747, born Jan. 12, 1896, in-calf, bred by James Cunningham, Tarbreoch, Dalbeattie; *s.* Campfollower 5042, *d.* Maggie of Tarbreoch 8613 by Scottish Borderer 669.
- 1099 III. (£5).—CHRISTOPHER GRAHAM, Harelawhill, Canonbie, N.B., for *Jane Stanley* 4th<sup>1</sup> 14777, born March 29, 1896, in-calf; *s.* The Pathfinder 3rd 5991, *d.* Jane Stanley 11124 by Greentick 3729.
- 1101 R. N. & H. C.—WM. PARKIN-MOORE, for *Mae's Tidy* of Whitehall.
- 1102 Com.—J. B. G. TOTTIE, for *Nannie* of Castlemilk.

**Class 131.—Galloway Heifers, calved in 1898.** [6 entries, 1 absent.]

- 1106 I. (£10).—R. T. SCOTT, Drumhughry, Dalbeattie, for *Bell* 13th of Drumhughry 15540, born Jan. 16; *s.* Contender 4th of Tarbreoch 5994, *d.* Bell 7th of Drumhughry by Scottish Hero of Tarbreoch 5300.
- 1108 II. (£5).—J. B. G. TOTTIE, Coniston Cold, Bell Busk, Leeds, for *Hannah* 24th 16294, born March 27, bred by R. F. Dudgeon, Cargen, Dumfries; *s.* Cedric of Naworth 6634, *d.* Hannah 21st by Tribune 5295.
- 1105 R. N. & H. C.—R. T. SCOTT, for *Bell* 12th of Drumhughry.
- 1104 H. C.—ROBERT JEFFERSON, for *In Clover*.
- 1109 Com.—J. B. G. TOTTIE, for *Mary* 9th.

**Class 132.—Galloway Heifers, calved in 1899.**

[5 entries, 1 absent.]

- 1114 I. (£10).—ROBERT WILSON, Kilquhanity Farm, Dalbeattie, for *Maggie* of Kilquhanity 16295, born Jan. 13, bred by James Cunningham, Tarbreoch, Dalbeattie; *s.* Banner of Naworth 6986, *d.* Maggie 10th of Tarbreoch by Campfollower 5042.

<sup>1</sup> Subject to compliance with Regulation as to calving.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1110 II. (£5.)—WM. PARKIN-MOORE, Whitehall, Mealsgate, Cumberland, for Dame Tidy of Whitehall 15921, born April 8; s. Baron Garlies 6388, d. Mac's Tidy of Whitehall 14026 by Macdougall 3rd of Tarbreoch 5840.
- 1113 R. N. & H. C.—ROBERT WILSON, for Louisa 2nd of Kilquhanity.
- 1111 Com.—LEONARD PILKINGTON, for Isabel 3rd of Cavena.

## Highland.

### Class 133.—*Highland Bulls, calved before or in 1897.*<sup>1</sup>

[8 entries, 2 absent.]

- 1122 I. (£15, & Champion.\*)—THE EARL OF SOUTHESK, K.T., Kinnaird Castle, Brechin, Forfarshire, for Laoich 1260, yellow, born April 17, 1894, bred by John Stewart, Ensay, Portree, Inverness-shire; s. Caetharnach Buidhe 719, d. Shellay 3rd 2351 by Morair 681.
- 1118 II. (£10, & R. N. for Champion.)—W. D. MACKENZIE, Farr House, Daviot, Inverness, for Calum Ban of Atholl 1203, light dun, born Jan. 21, 1895, bred by the Duke of Atholl, K.T., Blair Castle, Perthshire; s. Valentine 5th 1062, d. Te Buidhe 1379 by Calum Odhar of Atholl 79.
- 1121 III. (£5.)—T. V. SMITH, Ardtornish, Morvern, R.S.O., Argyllshire, for Ailean Riabhach of Atholl 1296, brindled, born Jan. 29, 1897, bred by the Duke of Atholl, K.T., Blair Castle, Perthshire; s. An Duichd Riabhach 1175, d. Te Buidhe 1379 by Calum Odhar of Atholl 79.
- 1120 R. N. & H. C.—WALTER SHOOLBREED, for An Gille Glio.
- 1116 Com.—SIR R. A. E. CATHCART, Bt., for Freacadan Deorg.

### Class 134.—*Highland Bulls, calved in 1898.*

[5 entries, none absent.]

- 1124 I. (£15.)—DONALD T. MARTIN, Dunlossit, Portaskaig, Isle of Islay, for Percy 1407, brindled, born Jan. 19, bred by the Earl of Southesk, K.T., Kinnaird Castle, Brechin; s. Caetharnach Buidhe 719, d. Beusach Odha 1806 by Black Prince 45.
- 1123 II. (£10.)—J. S. AINSWORTH, Ardarnaiseig, Kilchrenan, Argyllshire, for An Sergeant 11th, light red, born March 10, bred by W. McGillivray, Garbole, Tomatin, Inverness; s. Fear-a-Bhaile of Moyhall 1354, d. Maggy of Garbole 3213 by An Serjean 632.
- 1125 III. (£5.)—LORD MIDDLETON, Applecross, Kyle, Ross-shire, for An Seanalair Og, brindled, born Jan. 17, bred by Messrs. A. D. & D. MacGregor, Kinlochmoidart, Fort William; s. An Seanalair Ross 1181, d. Shellay Ruadh of Kinlochmoidart 2383 by Calum Mor 77.
- 1127 R. N. & H. C.—H. C. STEPHENS, M.P., for Valentine of Cholderton.

### Class 135.—*Highland Bulls, calved in 1899.* [6 entries.]

- 1130 I. (£15.)—T. V. SMITH, Ardtornish, Morvern, R.S.O., Argyllshire, for Victor 21st 1600, brindled, born Feb. 3; s. Ailean Riabhach of Atholl 1296, d. Sgiathach 21st 4228 by An Gaisgeach 971.
- 1133 II. (£10.)—THE DUKE OF SUTHERLAND, Dunrobin Castle, Golspie, Sutherlandshire, for Ben a' Bhraggie, brindled, born Feb. 14; s. Victor 13th 1290, d. Nell 2nd by Gille Molach 1242.
- 1132 III. (£5.)—THE EARL OF SOUTHESK, K.T., Kinnaird Castle, Brechin, Forfarshire, for Thorstein, yellow, born April 12; s. Caetharnach Bhuidhe 719, d. Astrid 3377 by An-T'-Iasgair 13.

<sup>1</sup> Prizes given by the York Local Committee.

\* Champion Prize of £15 given by the Highland Cattle Society for the best Highland Bull exhibited in Classes 133-135.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1131 **B. N. & H. C.**—T. V. SMITH, Morvern, for Victor 22nd.  
 1128 **H. C.**—J. S. AINSWORTH, for Rob Riabhach.  
 1129 **Com.**—DONALD GRAHAM, for Mac-a-Craig.

**Class 136.—Highland Cows (in-milk or in-calf), calved before or in 1896.<sup>1</sup> [12 entries, 2 absent.]**

- 1135 **I. (£15, & B. N. for Champion.)**—GEORGE BULLOUGH, Rum, Inverness-shire, for Rhoama 3928, brindled, born in Feb., 1895, in-milk, calved Jan. 3, 1900, bred by T. V. Smith, Ardtornish, Morvern; s. Victor 5th 951, d. Sgiathach 8th 3371 by Victor 2nd 829.  
 1140 **II. (£10.)**—WILLIAM NIMMO, Castle Eden, Co. Durham, for Blackie 3858, black, born in 1890, in-milk, calved Jan. 22, 1900, bred by T. V. Smith, Ardtornish, Morvern; s. An-T'-Iasgair 13, d. Dubh Liuin 690.  
 1141 **III. (£5.)**—T. V. SMITH, Ardtornish, Morvern, R.S.O., Argyllshire, for Phroiseag 4th of Ardtornish 2275, yellow, born in Jan., 1890, in-milk, calved Jan. 2, 1900; s. An-T'-Iasgair 13, d. Phroiseag Odhar 2nd 1250 by Coirintee 115.  
 1145 **B. N. & H. C.**—THE DUKE OF SUTHERLAND, for Morag 2nd of Dunrobin.  
 1134 **H. C.**—H.R.H. THE PRINCE OF WALES, K.G., for Stalc Buidhe 3rd.  
**Com.**—W. D. MACKENZIE, for No. 1136, Fearag of Farr; LORD MID-  
 DLETON, for No. 1138, Riabhach Ruadh 3rd of Applecross, and No.  
 1139, Ullinish Ruadh 3rd.

**Class 137.—Highland Heifers, calved in 1897. [3 entries.]**

- 1147 **I. (£10, & Champion.)**—T. V. SMITH, Ardtornish, Morvern, R.S.O., Argyllshire, for Cruinneag 6th of Ardtornish, red, born Jan. 6; s. Victor 13th 1290, d. Cruinneag 4th of Ardtornish 3798 by Victor 5th 951.  
 1146 **II. (£5.)**—WILLIAM NIMMO, Castle Eden, Co. Durham, for Angusina, yellow, born in May, bred by The Mackintosh of Mackintosh, Moy Hall; s. Ixion 1126, d. Angusina of Moy Hall 2785 by Duke 736.  
 1148 **B. N. & H. C.**—THE DUKE OF SUTHERLAND, for Millicent of Dunrobin.

**Class 138.—Highland Heifers, calved in 1898. [6 entries.]**

- 1152 **I. (£10.)**—THE EARL OF SOUTHERSK, K.T., Kinnaird Castle, Brechin, Forfarshire, for Lady Clara 4234, yellow, born Jan. 1; s. Ceatharnach Buidhe 719, d. Clara Clare 1258 by Sergeant Buidhe 619.  
 1153 **II. (£5.)**—THE EARL OF SOUTHERSK, K.T., for Lady Dee, yellow, born Jan. 22; s. Ceatharnach Buidhe 719, d. Desdemona 3382 by An-T'-Iasgair.  
 1149 **B. N. & H. C.**—GEORGE BULLOUGH, Rum, for Sonsaig of Rum.  
 1151 **H. C.**—T. V. SMITH, for May Queen 5th.  
**Com.**—W. D. MACKENZIE, for No. 1150, Banrigh of Farr; THE DUKE  
 OF SUTHERLAND, for No. 1154, Taragheal of Dunrobin.

**Ayrshires.**

**Class 139.—Ayrshire Bulls, calved in 1896 or 1897. [1 entry.]**

- 1155 **I. (£15.)**—ANDREW MITCHELL, Barcheskie, Kirkcudbright, for Com-  
 mander of Southwick 3762, white, born April 12, 1897, bred by Sir M. J.  
 McTaggart Stewart, Bt., M.P., Southwick, Dumfries; s. First Choice  
 of Southwick 3005, d. Princess 6th of Southwick 9383 by Blooming  
 Heather of Drumjoan 1918.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Prize of £15 given by the Highland Cattle Society for the best Highland Cow or Heifer exhibited in Classes 136-138.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 140.—Ayrshire Bulls, calved in 1898.** [2 entries, 1 absent.]

- 1157 I. (£15).—SIR M. J. McTAGGART STEWART, BT., M.P., Southwick, Dumfries, for *Maasher* of Southwick 4138, white with brown spots, born April 16; *s.* Queen's Messenger of Cavens 3962, *d.* Princess 4th of Southwick 8104 by Robin Harvey of Southwick 2119.

**Class 141.—Ayrshire Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897.** [3 entries, 1 absent.]

- 1160 I. (£15).—ANDREW MITCHELL, Barcheskie, Kirkcudbright, for *Queen of the Meadow* 11704, white and brown, born March, 1897, in-milk, calved May 7, 1900, bred by Matthew Templeton, Dromore, Kirkcudbright; *s.* Private of Knockdon 2113, *d.* Queen of the Meadow of Dromore 8946 by Father O'Flynn of Gariaff 1987.
- 1159 II. (£10).—ALEXANDER CROSS, Knockdon Farm, Maybole, Ayrshire, for *Snowflake* 2nd of Aitchison's Bank 11766, brown and white, born May 15, 1897, calved July 13, 1900, bred by Andrew Mackie, Aitchison's Bank, Greta, Dumfries; *s.* Knockdon of Aitchison's Bank 3323, *d.* Snowflake 2nd of Castlehill 8797 by Peter of Whitehill 1397.

**Class 142.—Ayrshire Heifers, calved in 1898.** [3 entries.]

- 1161 I. (£10).—ANDREW MITCHELL, Barcheskie, Kirkcudbright, for *Mary* 13167, white and brown, born March 3, bred by James Howie, Hillhouse, Kilmarnock; *s.* Traveller's Heir of Hobhouse 2903, *d.* Nancy of Hillhouse by Sir George 201.
- 1163 II. (£5).—SIR M. J. McTAGGART STEWART, BT., M.P., Southwick, Dumfries, for *Princess* 9th of Southwick 12535, brown and white, born Feb. 7; *s.* Queen's Messenger of Cavens 3962, *d.* Princess 6th of Southwick 9383 by Blooming Heather of Drumjoan 1918.
- 1162 B. N. & H. C.—SIR M. J. McTAGGART STEWART, BT., M.P., for *Betty* 8th of Southwick.

## Jerseys.

*N.B.—In the Jersey Classes the number inserted within brackets after the name of an animal indicates the number of such animal in the Island Herd Book. A number without brackets indicates that the animal is registered in the English Jersey Herd Book.*

**Class 143.—Jersey Bulls, calved in 1896, 1897, or 1898.**  
[14 entries, 2 absent.]

- 1168 I. (£15).—MRS. CYRIL E. GREENALL, Walton Hall, Warrington, for *Golden Monarch* 6241, dark brown, born Jan. 7, 1897, bred by J. Dreland, Trinity, Jersey; *s.* Golden Lad 2nd 5177, *d.* Agenoria 3rd (4125) P.S.C. by Daisy's Memory 6186.
- 1167 II. (£10).—SIR REGINALD GRAHAM, BT., Norton Conyers, Ripon, for *Dignity* 6525, whole colour, born Sept. 30, 1898, bred by W. Alexander, St. Mary's, Jersey; *s.* Castor's Pride 5496, *d.* Gladness (vol. x. p. 251, imported) by Castor's Pride 5496.
- 1173 III. (£5).—MRS. AUGUSTUS F. PERKINS, Oakdene, Holmwood, Surrey, for *Spot Stroke*, whole colour, born March 19, 1898; *s.* Grey Duke 5576, *d.* Spot 4th (vol. vi. p. 566) by Marius 2nd 3513.
- 1170 B. N. & H. C.—COL. H. L. B. MCCALMONT, M.P., for *Golden Spring*.  
H. C.—ANTONY GIBBS, for No. 1166, *Lord Bourton*; THE DUKE OF MARLBOROUGH, for No. 1172, *Dewey*; PICKERING PHIPPS, for No. 1174, *Gipay Premier*; LORD ROTHSCHILD, for No. 1175, *Butter Test*.
- 1164 Com.—EARL CADOGAN, K.G., for *Haverling Pride*.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 144.—Jersey Bulls, calved in 1899.** [20 entries, 4 absent.]

- 1188 I. (£10).—COL. H. L. B. MCCALMONT, M.P., Bishopswood, Ross, Herefordshire, for *Chief Justice*, whole colour, born July 11; *s.* Chancellor 6500, *d.* Wigton 6th (vol. vi. p. 630) *by* Flora's Lad 4098.
- 1185 II. (£5).—MRS. CYRIL E. GREENALL, Walton Hall, Warrington, for *Bugler 2nd*, whole colour, born May 4; *s.* Golden Monarch 6241, *d.* Peronne (vol. x. p. 310, imported) *by* Bugler 5486.
- 1191 B. N. & H. C.—A. MILLER-HALLETT, Chelsfield, for *Free Stater*.  
H. C.—E. MURRAY IND, for No. 1187, *Enchanter*; LORD ROTHSCHILD, for No. 1195, *Perry Farm Duplex*.  
Com.—EARL CADOGAN, K.G., for No. 1179, *General Buller*; MRS. GREENALL, for No. 1186, *Longueville Monarch*; MRS. MCINTOSH, for No. 1189, *Why Not*; MRS. PERKINS, for No. 1192, *Bobby*; PICKERING PHIPPS, for No. 1193, *Harmonic*.

**Class 145.—Jersey Cows (in-milk), calved in 1894, 1895, 1896, or 1897.** [26 entries, 6 absent.]

- 1200 I. (£15).—C. W. ARMITAGE, Woodlands, Northaw, Potter's Bar, for *Melvina 3rd* (vol. viii. p. 226), whole colour, born Feb. 4, 1894, in-milk, calved April 10, 1900, bred by J. P. Falle, St. Mary's, Jersey; *s.* Lowland King 4616, *d.* Melvina (2806) F.S.C.
- 1221 II. (£10).—G. MURRAY SMITH, Gumley Hall, Market Harborough, for *Sultana* (vol. ix. p. 299), whole colour, born April 7, 1895, in-milk, calved April 30, 1900, bred by Lord Rothschild, Tring Park, Herts; *s.* Spot's Lad 4389, *d.* Regina's Sultana (imported).
- 1220 III. (£5).—G. MURRAY SMITH, Market Harborough, for *La Chasse Camellia* (vol. ix. p. 240), whole colour, born April 25, 1895, in-milk, calved May 13, 1900, bred by P. Le Brocq, St. Owen's, Jersey; *s.* Sir June 5393, *d.* Amelie (3630) P.S.C., *by* Grant's Lad 3340.
- 1210 B. N. & H. C.—MRS. CHARLOTTE MCINTOSH, for *Glorissa 3rd*.  
H. C.—C. W. ARMITAGE, for No. 1201, *Mignonne*; MRS. GREENALL, for No. 1205, *Longueville Brownie 4th*; COL. MCCALMONT, M.P., for No. 1208, *Lottie*; MRS. MCINTOSH, for No. 1211, *Linda*; LORD ROTHSCHILD, for No. 1217, *Jewel*, No. 1218, *Lotus Lily*, and No. 1219, *Ellen 2nd*.  
Com.—MRS. GREENALL, for No. 1206, *Longueville Brownie 5th*; COL. MCCALMONT, M.P., for No. 1207, *Freedom*; MRS. MCINTOSH, for No. 1209, *Charlotte 6th*; A. MILLER-HALLETT, for No. 1212, *Fancy Aster 3rd*.

**Class 146.—Jersey Heifers (in-milk or in-calf), calved in 1898.** [31 entries, 11 absent.]

- 1225 I. (£15).—C. W. ARMITAGE, Woodlands, Northaw, Potter's Bar, for *Flora's Daughter* (vol. xi.), whole colour, born May 18, in-milk, calved April 19, 1900, bred by W. McKenzie Bradley, Leylands, Meopham, Kent; *s.* Flora's Champion 5882, *d.* Grand Daughter (vol. vi. p. 243, imported) *by* Sir William 2nd 3810.
- 1252 II. (£10).—LORD ROTHSCHILD, Tring Park, Herts, for *Golden Lass*, broken colour, born March 25, in-milk, calved April 17, 1900; *s.* Wigton's Cicero 5769, *d.* Dairy's Golden (vol. viii. p. 198) *by* Golden Lad 3324.
- 1242 III. (£5).—MRS. CHARLOTTE MCINTOSH, Havering Park, Romford, for *Pearl 4th*, grey, born Jan. 12, in-milk, calved May 4, 1900, bred by C. Le Sueur, Grouville, Jersey; *s.* Golden Fern's Lad 6236, *d.* Pearl 3rd (6516).
- 1227 B. N. & H. C.—EARL CADOGAN, K.G., for *Beatrice*.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

H. C.—P. H. FOWLER, for No. 1230, *Alfriston Pride 6th*; E. MURRAY IND, for No. 1238, *Mon Plaisir's Lady*; MRS. MCINTOSH, for No. 1240, *Clementine 4th*; LORD ROTHSCHILD, for No. 1253, *Oxford Sunrise*.  
Com.—MRS. PERKINS, for No. 1246, *Les Pres*, and No. 1247, *Miss Garfield*.

**Class 147.—Jersey Heifers, calved in 1899** [30 entries, 6 absent.]

- 1275 I. (£15).—MRS. AUGUSTUS F. PERKINS, Oakdene, Holmwood, Surrey, for *Mrs. Bardell*, light fawn, born March 15; s. *Grey Duke 5576*, d. *Mrs. Butterwick* (vol. vi. p. 87) by *King Ethelred 4214*.  
1265 II. (£10).—MRS. CYRIL E. GREENALL, Walton Hall, Warrington, for *La Chasse Linda*, dark brown, born Jan. 6, bred by P. Le Brocq, St. Owen's, Jersey; s. *Clio (2620)*, d. *Becquet's Jubilee 2nd (3494)*.  
1271 III. (£5).—COL. H. L. B. McCALMONT, M.P., Bishopwood, Ross, Herefordshire, for *Danger*, fawn, born March 30; s. *Red Rag 6381*, d. *Surprise* (vol. vi. p. 580, imported) by *Golden Lad 3324*.  
1274 R. N. & H. C.—MRS. AUGUSTUS F. PERKINS, for *Lady of Lyons*.  
H. C.—EARL CADOGAN, K.G., for No. 1259, *Lady Blucher*; L. G. GISBORNE, for No. 1264, *L'Etacq Bessie*; E. MURRAY IND, for No. 1269, *Topsy*, and No. 1270, *Willow*; MRS. MCINTOSH, for No. 1272, *Forget-me-not*; LORD ROTHSCHILD, for No. 1280, *Grace Darling*.  
Com.—C. W. ARMITAGE, for No. 1255, *Belle of Leylands*; BROUGH & CHALLINOR, for No. 1257, *Butterfly Witch*; LORD ROTHSCHILD, for No. 1281, *Regina's Sultana 6th*.

**Guernseys.**

*N.B.—Unless otherwise stated, the numbers refer to the English Guernsey Herd Book.*

**Class 148.—Guernsey Bulls, calved in 1896, 1897, or 1898.**

[13 entries, 1 absent.]

- 1288 I. (£15).—W. A. GLYNN, Seagrove, Seaview, Isle of Wight, for *Frolic 6th 899*, orange fawn and white, born Feb. 28, 1896; s. *Frolic 5th 612*, d. *Favourite 9th 760* by *Hopeful 25*.  
1296 II. (£10).—MRS. MONTEFIORE, Worth Park, Crawley, Sussex, for *Signalman 2nd 1048*, fawn and white, born Feb. 22, 1897; s. *Signalman 585*, d. *Miranda 6th 2253*.  
1287 III. (£5).—W. HERBERT FOWLER, Claremont, Taunton, for *Claremont Westward Ho 1091*, pale red and white, born Jan. 14, 1897, bred by T. Mahy, St. Martin's, Guernsey; s. *Loyal of the Hungnets 978 P.S.*, R.G.A.S., d. *Lily of Calais 1604 F.S.*, R.G.A.S., by *Ajax 208 P.S.*, R.G.A.S.  
1295 R. N. & H. C.—MRS. MONTEFIORE, for *Lord Bobs*.  
H. C.—J. C. FORSTER, for No. 1286, *Captain Lyons*; THE EARL OF HAREWOOD, for No. 1291, *Uncle Peter 2nd*; LADY TICHEBORNE, for No. 1297, *Itchen Jewel*.

**Class 149.—Guernsey Bulls, calved in 1899.** [11 entries, 1 absent.]

- 1801 I. (£10).—E. A. HAMBRO, Hayes Place, Kent, for *Hayes Prince 1205*, fawn and white, born Nov. 1; s. *Cobo Prince 1147*, d. *Silver Spade 4649* by *Sly-of-the-Bordages 988 P.S.*, R.G.A.S.  
1800 II. (£5).—W. A. GLYNN, Seagrove, Seaview, Isle of Wight, for *Billy 8th 1187*, orange fawn and white, born May 1; s. *Frolic 6th 899*, d. *Seaview Rose 3921*.  
1804 R. N. & H. C.—H. M. OZANNE, Castel, Guernsey, for *Golden Rule*.  
H. C.—W. HERBERT FOWLER, for No. 1299, *Claremont Hoylake*; H. M. OZANNE, for No. 1305, *Kimberley*.  
1807 Com.—H. F. PLUMPTRE, for *Suzerain*.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 150.—Guernsey Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897. [15 entries, 2 absent.]**

- 1310 I. (£15).—THE HON. MRS. A. BAILLIE-HAMILTON, Burley Lodge, Ringwood, Hants, for Jessie 10th 2701, fawn and a little white, born Aug. 22, 1894, in-milk, calved May 25, 1900; s. Day Star 539, d. Jessie 8th 1592 by Loyalist 103.
- 1315 II. (£10).—E. A. HAMBRO, Hayes Place, Kent, for Charmante of the Gron 3636, pale red and white, born July 7, 1896, in-milk, calved April 18, 1900, bred by J. Bourgaize, Gron, St. Saviour's, Guernsey; s. His Royal Majesty 1106, d. Charmante 5th 2619 P.S., R.G.A.S.
- 1313 III. (£5).—W. HERBERT FOWLER, Claremont, Taunton, for Claremont Jessie 2nd, 3646, fawn and white, born Jan. 3, 1897, in-milk, calved April 3, 1900; s. Claremont Scamp 880, d. Claremont Jessie 2625 by Power 602 P.S., R.G.A.S.
- 1323 B. N. & H. C.—LADY TICHBORNE, for Daisy Pearl.  
H. C.—J. E. ELLIS, M.P., for No. 1311, Patience 2nd; H. F. PLUMPTRE, for No. 1322, Lady Ashurst.

**Class 151.—Guernsey Heifers, calved in 1898. [17 entries, 5 absent.]**

- 1328 I. (£10).—J. C. FORSTER, Clatford Mills, Andover, Hants, for Clatford Gentle 6218 G.H.B., fawn and white, born in January, bred by T. Le Page, Beaulieu, St. Andrew's, Guernsey; s. Loyal of the Hunguets 978 P.S., R.G.A.S., d. Lady West.
- 1338 II. (£5).—H. M. OZANNE, Lilyvale, Castel, Guernsey, for Queen of Holland 4177 P.S., R.G.A.S., fawn and white, born Feb. 13; s. Massachusetts 293 F.S., R.G.A.S., d. Surahbi 3rd 3146 P.S., R.G.A.S.
- 1340 B. N. & H. C.—LADY TICHBORNE, for Royal Rose.  
H. C.—P. H. FOWLER, for No. 1330, Princess of the Briquet 5th; W. HERBERT FOWLER, for No. 1332, Claremont Water Lily; MRS. MONTEFIORE, for No. 1335, Katrine; LADY TICHBORNE, for No. 1339, Ithen Beda.

**Class 152.—Guernsey Heifers, calved in 1899. [9 entries, 1 absent.]**

- 1344 I. (£10).—E. A. HAMBRO, Hayes Place, Kent, for Hayes Princess 3rd 4467, red and white, born Jan. 1; s. Amphion 753, d. Hayes Princess 8013 by Paramour 718.
- 1342 II. (£5).—W. HERBERT FOWLER, Claremont, Taunton, for Claremont Victoria 4394, red and white, born May 24; s. Claremont Westward Ho 1091, d. Claremont Fuchsia 3291 by Billy.
- 1348 B. N. & H. C.—MRS. MONTEFIORE, for Claremont Flora 3rd.
- 1341 H. C.—J. C. FORSTER, for Antona 9th.

## Kerries.

**Class 153.—Kerry Bulls, calved in 1896, 1897, 1898, or 1899. [4 entries, 1 absent.]**

- 1352 I. (£10, & B. N. for Champion.<sup>1</sup>)—ROBERTSON & SONS, Church Farm, Babraham, Cambridge, for La Mancha Bobs, black, born May 25, 1899, bred by R. Barter, St. Anne's, Co. Cork; s. Aicme Prince 349, d. Aicme Venus 1532.

<sup>1</sup> Challenge Cup, value Twenty-five Guineas, offered by the English Kerry and Dexter Cattle Society for the best Kerry animal exhibited in Classes 153 and 154. The Cup to become the property of an Exhibitor winning it three years in succession.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1351 II. (£5.)—THE DUCHESS OF NEWCASTLE, Clumber, Worksop, for Hardwick La Mancha Merry Boy, black, born July 3, 1898, bred by R. Barter, Blarney, Co. Cork; s. Alcme Prince, 849, d. Alcme Carlou 2540.
- 1350 B. N.—W. H. MULLENS, Westfield Place, Battle, for Waterville Sirdar.

**Class 154.—Kerry Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896 or 1897.** [5 entries, none absent.]

- 1357 I. (£10, & Champion.<sup>1</sup>)—ROBERTSON & SONS, Church Farm, Babraham, Cambridge, for La Mancha Fan 2558, black, born 1896, in-milk, calved Dec. 4, 1899, breeder unknown.
- 1358 II. (£5.)—ROBERTSON & SONS, Babraham, for La Mancha Goletta 2422, black, born in 1895, in-milk, calved March 14, 1900, breeder unknown.
- 1354 B. N. & H. C.—W. H. MULLENS, for La Mancha Vesta.

## Dexters.

**Class 155.—Dexter Bulls, calved in 1896, 1897, 1898, or 1899.**  
[6 entries, none absent.]

- 1363 I. (£10, & Champion.<sup>2</sup>)—ROBERTSON & SONS, Church Farm, Babraham, for La Mancha Union Jack 87, red, born in 1898, breeder unknown.
- 1361 II. (£5.)—COUNTESSE DE LA WARR, The Manor House, Bexhill-on-Sea, for Buckhurst Khalifa 317, red, born March 20, 1898; s. La Mancha The Doctor 342, d. Framfield Opal 811.
- 1362 B. N.—ROBERTSON & SONS, for La Mancha John Bull.

**Class 156.—Dexter Cows or Heifers (in-milk or in-calf), calved in 1894, 1895, 1896, or 1897.** [8 entries, none absent.]

- 1367 I. (£10, & B. N. for Champion.<sup>2</sup>)—BALDOMERO DE BERTODANO, Cowbridge House, Malmesbury, for Cowbridge Tiny Ann 34, black, born in 1897, in-milk, calved May 21, 1900, breeder unknown.
- 1370 II. (£5.)—ROBERTSON & SONS, Church Farm, Babraham, Cambridge, for La Mancha Nimble Girl, black, born in 1897, in-milk, calved May 19, 1900, breeder unknown.
- 1365 B. N. & H. C.—H.R.H. THE PRINCE OF WALES, K.G., for Dainty Girl.  
H. C.—BALDOMERO DE BERTODANO, for No. 1366, Cowbridge Love Lost;  
COUNTESSE DE LA WARR, for No. 1369, Waterville Alma.

## Dairy Cattle.

**Class 157.—Dairy Cows (in-milk), of any breed or cross.**  
[11 entries, 5 absent.]

- 1383 I. (£15.)—WILLIAM WALSH, Gilstead, Bingley, Yorks, for roan, calved April 27, 1900, breeder unknown.
- 1375 II. (£10.)—RICHARD EWBANK, The Temple, Leyburn, Yorks, for Beauty (Shorthorn), roan, born April 7, 1895, calved June 1, 1900, breeder unknown.
- 1379 III. (£5.)—MRS. FRANCES PRATT, Camp Hill, Henley-in-Arden, for Snowdrop (Shorthorn), white, born March 2, 1891, calved May 24, 1900; s. Barrington Emperor 56924, d. Dowager by Granite 47984.
- 1376 B. N. & H. C.—GEORGE HARRISON, Gainford Hall, for Dairymaid.

<sup>1</sup> Challenge Cup, value Twenty-five Guineas, offered by the English Kerry and Dexter Cattle Society for the best Kerry animal exhibited in Classes 153 and 154. The Cup to become the property of an Exhibitor winning it three years in succession.

<sup>2</sup> Challenge Cup, value Twenty-five Guineas, offered by the English Kerry and Dexter Cattle Society for the best Dexter animal exhibited in Classes 155 and 156. The Cup to become the property of an Exhibitor winning it three years in succession.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## SHEEP.

By "TWO SHEAR" and "SHEARLING" are meant sheep born in 1898 and 1899 respectively.

### Leicesters.

**Class 158.—Leicester Two-Shear Rams.** [7 entries, none absent.]

- 1387 I. (£10, & Champion.<sup>1</sup>)—GEORGE HARRISON, Gainford Hall, Darlington, for Royal Maidstone, born March.  
 1390 II. (£5, & R. N. for Champion.<sup>1</sup>)—J. J. SIMPSON, Pilmoor House, Hunmanby, Yorks, born March.  
 1386 R. N. & H. C.—JOHN DOWSON, Danby Castle, York, born March.  
 1388 Com.—E. F. JORDAN.

**Class 159.—Leicester Shearling Rams.** [16 entries, none absent.]

- 1404 I. (£15.), & 1402 II. (£10.)—E. F. JORDAN, Driffield, born March.  
 1398 III. (£5.), & 1400 R. N. & H. C.—GEORGE HARRISON, Gainford Hall, Darlington, born Feb. or March.

**Class 160.—Pens of Three Leicester Ram Lambs.**  
 [5 entries, 1 absent.]

- 1409 I. (£10.)—GEORGE HARRISON, Gainford, Darlington, born Feb. or Mar.  
 1408 II. (£5.)—JOHN DOWSON, Danby Castle, Danby End, York, born March, bred by Miss Pierson, Kirby Bridge, Stokesley, Northallerton.  
 1411 R. N. & H. C.—J. J. SIMPSON, Pilmoor House, Hunmanby, born Feb.

**Class 161.—Pens of Three Leicester Shearling Ewes, of the same Flock.** [9 entries, none absent.]

- 1419 I. (£15.)—J. J. SIMPSON, Pilmoor House, Hunmanby, born March.  
 1416 II. (£10.)—GEORGE HARRISON, Gainford Hall, born Feb. or March.  
 1417 III. (£5.), & 1418 R. N.—E. F. JORDAN, Driffield, born March.

**Class 162.—Pens of Three Leicester Ewe Lambs.**  
 [4 entries, 1 absent.]

- 1422 I. (£10.)—GEORGE HARRISON, Gainford Hall, born Feb. or March.  
 1423 II. (£5.)—E. F. JORDAN, Eastburn, Driffield, born March.  
 1424 R. N. & H. C.—J. J. SIMPSON, Pilmoor House, Hunmanby, born Feb.

### Cotswolds.

**Class 163.—Cotswold Two-Shear Rams.** [3 entries.]

- 1425 I. (£10.), & 1426 II. (£5.)—B. & W. T. GARNE, Aldsworth, Northleach, Glos., born Jan.  
 1427 R. N.—WM. HOULTON, Broadfield Farm, Northleach, born Feb.

**Class 164.—Cotswold Shearling Rams.** [8 entries, none absent.]

- 1434 I. (£15.)—RUSSELL SWANWICK, R. A. C. Farm, Cirencester, born Jan. 28.  
 1428 II. (£10.)—R. & W. T. GARNE, Aldsworth, Northleach, born Jan.  
 1431 III. (£5.)—WM. HOULTON, Broadfield Farm, Northleach, born Jan.  
 1433 R. N. & H. C., & 1435 Com.—RUSSELL SWANWICK.

<sup>1</sup> Champion Prize of £5, given by the Leicester Sheep Breeders' Association for the best Leicester Ram exhibited in Classes 158 and 159.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 165.—Pens of Three Cotswold Ram Lambs.**

[3 entries.]

- 1436 I. (£10).—R. & W. T. GARNE, Aldsworth, Northleach, born Jan.  
1437 II. (£5.), & 1438 B. N.—RUSSELL SWANWICK, R. A. C. Farm, Cirencester.

**Class 166.—Pens of Three Cotswold Shearling Ewes, of the same Flock.** [6 entries.]

- 1439 I. (£15.), & 1440 III. (£5.).—R. & W. T. GARNE, Aldsworth, born Jan.  
1441 II. (£10).—WM. HOULTON, Broadfield Farm, Northleach, born Jan. & Feb.  
1443 B. N. & H. C.—RUSSELL SWANWICK, R. A. C. Farm, Cirencester.  
Com.—WM. HOULTON, for No. 1442; R. SWANWICK, for No. 1444.

**Class 167.—Pens of Three Cotswold Ewe Lambs.**

[2 entries.]

- 1445 I. (£10).—R. & W. T. GARNE, Aldsworth, Northleach, born Jan.  
1446 II. (£5.).—RUSSELL SWANWICK, R. A. C. Farm, Cirencester, born Jan.

## Lincolns.

**Class 168.—Lincoln Two-Shear Rams.** [5 entries, none absent.]

- 1447 I. (£10, & B. N. for Champion.<sup>1</sup>)—TOM CASSWELL, Pointon House, Folkingham, for Pointon Maidstone, born Feb.; s. Cracker 2nd 2546, d. by Riby Gordon.  
1448 II. (£5.).—S. E. DEAN & SONS, Dowsby Hall, Bourne, Lincs, born Feb., bred by J. E. Casswell, Laughton, Folkingham; s. Laughton Riby 732.  
1451 B. N.—J. M. STRICKLAND, for Brandsby's First Fruits.

**Class 169.—Lincoln Shearling Rams.** [22 entries, 5 absent.]

- 1464 I. (£15, & Champion.<sup>1</sup>) & 1462 III. (£5.).—HENRY DUDDING, Riby Grove, Great Grimsby, born Feb. 23.  
1473 II. (£10.), & 1472 B. N. & H. C.—R. & W. WRIGHT, Nocton Heath, born Feb.  
1455 H. C.—J. E. CASSWELL.  
Com.—J. PEARS, for No. 1465; HENRY SMITH, JUN., for Nos. 1466 & 1467.

**Class 170.—Pens of Five Lincoln Shearling Rams.<sup>2</sup>**

[8 entries, none absent.]

- 1478 I. (£15.).—HENRY DUDDING, Riby Grove, Gt. Grimsby, born Feb.  
1481 II. (£10.).—R. & W. WRIGHT, Nocton Heath, Lincoln, born Feb.  
1476 III. (£5.).—TOM CASSWELL, Pointon House, Folkingham, born Feb.  
1475 B. N. & H. C.—J. E. CASSWELL, Laughton, Folkingham, born Feb.  
H. C.—S. E. DEAN & SONS, for No. 1477; JOHN PEARS, for No. 1479.

**Class 171.—Pens of Three Lincoln Ram Lambs.**

[8 entries, 2 absent.]

- 1488 I. (£10.).—R. & W. WRIGHT, Nocton Heath, Lincoln, born Feb.  
1487 II. (£5.).—JOHN PEARS, Mere, Lincoln, born Feb.  
1482 B. N. & H. C.—S. E. DEAN & SONS, Dowsby Hall, Bourne, born Feb. 2.  
1486 H. C.—HENRY DUDDING.

<sup>1</sup> Champion Prize of £10 10s. given by the Lincoln Long Wool Sheep Breeders' Association for the Best Lincoln Ram exhibited in Classes 168 and 169.

<sup>2</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 172.—Pens of Three Lincoln Shearling Ewes, of the same Flock.**  
[6 entries, 1 absent.]

- 1491 I. (£15.), & 1492 III. (£5.)—HENRY DUDDING, Riby Grove, Great Grimsby, born Feb.  
1495 II. (£10.)—R. & W. WRIGHT, Nocton Heath, Lincoln, born Feb.  
1494 B. N. & H. C.—JOHN PEARS, Mere, Lincoln, born Feb.  
1490 H. C.—S. E. DEAN & SONS.

**Class 173.—Pens of Three Lincoln Ewe Lambs.**  
[7 entries, 2 absent.]

- 1502 I. (£10.)—R. & W. WRIGHT, Nocton Heath, Lincoln, born Feb.  
1497 II. (£5.), & 1496 B. N. & H. C.—S. E. DEAN & SONS, Dowsby Hall, Bourne, Linca, born Feb. 2.

**Oxford Downs.**

**Class 174.—Oxford Down Two-Shear Rams.**  
[5 entries, none absent.]

- 1503 I. (£10.), & 1504 B. N.—J. T. HOBBS, Maisey Hampton, born Feb.  
1506 II. (£5.)—J. & S. TREADWELL, Winchendon, Aylesbury, for No. 3, born about Feb. 10; s. Topsman 2441, d. by Traveller 2195.

**Class 175.—Oxford Down Shearling Rams.** [15 entries, 3 absent.]

- 1510 I. (£15.)—J. T. HOBBS, Maisey Hampton, Fairford, Glos., born Feb.  
1517 II. (£10.)—HUGH W. STILGOE, The Grounds, Adderbury, Banbury, born Jan. 14; s. Gillett's No. 9 of 1896, 2299, d. by Amateur 1064.  
1520 III. (£5.)—J. & S. TREADWELL, Winchendon, Aylesbury, born Feb.  
1508 B. N. & H. C.—JOHN C. EADY, Wellingboro', born Feb.  
H. C.—J. T. HOBBS, for No. 1512; J. & S. TREADWELL, for No. 1519.  
Com.—J. C. EADY, for No. 1509; J. T. HOBBS, for No. 1511; J. & S. TREADWELL, for No. 1518.

**Class 176.—Pens of Three Oxford Down Ram Lambs.**  
[6 entries, none absent.]

- 1525 I. (£10.)—W. J. P. READING, Rectory Farm, Langford, Lechlade, born Jan.; ss. Langford Hero and Adam's No. 141 of 1898, 2752.  
1524 II. (£5.)—R. W. HOBBS, Kelmscott, Lechlade, born Jan. 28.  
1527 B. N. & H. C.—GEORGE STREET, Maulden, Ampthill, born Feb.

**Class 177.—Pens of Three Oxford Down Shearling Ewes, of the same Flock.** [3 entries.]

- 1529 I. (£15.)—JOHN C. EADY, Irchester Grange, Wellingboro', born about Feb. 6; ss. Young Worley 1995 and Top Price 2680, ds. by Royal Darlington 2158 and Winchendon Hero 990.  
1530 II. (£10.)—JOHN C. EADY, Wellingboro', born about Feb. 6; ss. Young Worley 1995 and Winchendon Hopeful 2204, ds. by Testerton Royalty 966 and Royal Darlington 2158.  
1531 III. (£5.)—W. A. TREWEEKE, Ryne Hill, Chipping Norton, born March 10, 11, and 18.

**Class 178.—Pens of Three Oxford Down Ewe Lambs.**  
[6 entries, none absent.]

- 1537 I. (£10.)—W. A. TREWEEKE, Ryne Hill, Chipping Norton, born Jan.  
1533 II. (£5.)—R. W. HOBBS, Kelmscott, Lechlade, born about Jan. 28.  
1534 B. N. & H. C.—W. J. P. READING, Langford, Lechlade, born Jan.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## Shropshires.

### Class 179.—*Shropshire Two-Shear Rams.* [11 entries, 3 absent.]

- 1540 I. (£10.).—R. P. COOPER, Shenstone Court, Lichfield, born Feb., bred by D. Buttar, Corston, Coupar Angus, N.B.  
 1544 II. (£5.).—ANDREW E. MANSELL, Harrington Hall, Shifnal, born Feb., bred by J. Bowen-Jones, Ensdon House, Montford Bridge.  
 1542 B. N. & H. C.—JOHN HARDING, Norton House, Shifnal, born Feb.  
 H. C.—MRS. BARRS, for No. 1538; A. BRADBURN, for No. 1539; T. FENN, for No. 1541.  
 1546 Com.—T. S. MINTON.

### Class 180.—*Shropshire Shearling Rams.* [37 entries, 6 absent.]

- 1569 I. (£15.), & 1570 II. (£10.).—ANDREW E. MANSELL, Harrington Hall, Shifnal, born Feb.  
 1549 III. (£5.).—MRS. MARIA BARRS, Odstone Hall, Atherstone, born March.  
 1555 B. N. & H. C.—R. P. COOPER, Shenstone Court, Lichfield, born Feb.  
 H. C.—A. BRADBURN, for No. 1551; D. BUTTAR, for No. 1552; R. P. COOPER, for No. 1556; P. A. & G. T. EVANS, for No. 1558; T. FENN, for No. 1559; J. HARDING, for No. 1563; W. F. INGE, for Nos. 1567 & 1568; T. S. MINTON, for No. 1574; P. A. MUNTZ, M.P., for No. 1575; COL. SANDBACH, for No. 1577; THE EARL OF STRATHMORE, for Nos. 1578 & 1580; A. TANNER, for No. 1581.  
 Com.—D. BUTTAR, for Nos. 1553 & 1554; T. FENN, for No. 1560; G. L. FOSTER HARTER, for No. 1564; PHILO L. MILLS, for No. 1572; W. THOMAS, for No. 1582.

### Class 181.—*Pens of Five Shropshire Shearling Rams.*<sup>1</sup> [17 entries, 4 absent.]

- 1598 I. (£15.).—P. ALBERT MUNTZ, M.P., Dunsmore, Rugby, born about March 1.  
 1586 II. (£10.).—MRS. MARIA BARRS, Odstone Hall, born March.  
 1594 III. (£5.).—W. F. INGE, Thorpe Hall, Tamworth, born Feb. or March.  
 1588 B. N. & H. C.—DAVID BUTTAR, Coupar Angus, N.B., born March.  
 H. C.—R. P. COOPER, for No. 1589; P. A. & G. T. EVANS, for No. 1590; J. HARDING, for No. 1592; A. TANNER, for No. 1600.  
 Com.—T. FENN, for No. 1591; T. S. MINTON, for No. 1597; W. THOMAS, for No. 1601.

### Class 182.—*Pens of Three Shropshire Lamb Rams.* [13 entries, 3 absent.]

- 1609 I. (£10.), & 1610 II. (£5.).—ANDREW E. MANSELL, Harrington Hall, Shifnal, born Feb.  
 1611 B. N. & H. C.—PHILO L. MILLS, Ruddington Hall, Notts, born March.  
 H. C.—MRS. BARRS, for No. 1608; J. HARDING, for No. 1606.  
 Com.—P. A. MUNTZ, M.P., for No. 1612; H. C. G. PARKER, for No. 1613; W. THOMAS, for No. 1614; B. WALL, for No. 1615.

### Class 183.—*Pens of Three Shropshire Shearling Ewes, of the same Flock.* [15 entries, 2 absent.]

- 1625 I. (£15.).—W. F. INGE, Thorpe Hall, Tamworth, born Feb. or March.  
 1626 II. (£10.).—PHILO L. MILLS, Ruddington Hall, born Feb. and March.  
 1616 III. (£5.).—MRS. MARIA BARRS, Odstone Hall, Atherstone, born March.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1619 **B. N. & H. C.**—**R. P. COOPER**, Shenstone Court, Lichfield, born Feb.  
**H. C.**—**A. BRADBURN**, for No. 1617; **R. P. COOPER**, for No. 1618; **P. A. & G. T. EVANS**, for No. 1620; **W. F. INGE**, for No. 1624; **P. A. MUNTZ, M.P.**, for No. 1627; **THE EARL OF STRATHMORE**, for No. 1629; **A. TANNER**, for No. 1630.

**Class 184.—Pens of Three Shropshire Ewe Lambs.**

[12 entries, 2 absent.]

- 1639 **I. (£10.)**—**PHILO L. MILLS**, Ruddington Hall, Notts, born March.  
 1637 **II. (£5.)**—**ANDREW E. MANSELL**, Harrington Hall, Shifnal, born Feb.  
 1631 **B. N. & H. C.**—**MRS. MARIA BARRE**, Odstone Hall, born Feb.  
**H. C.**—**J. HARDING**, for No. 1634; **G. L. FOSTER HAETER**, for No. 1635;  
**A. E. MANSELL**, for No. 1638; **P. A. MUNTZ, M.P.**, for No. 1640; **B. WALL**, for No. 1642.  
 1641 **Com.**—**H. C. G. PARKER**.

**Southdowns.**

**Class 185.—Southdown Two-Shear Rams.** [11 entries, 1 absent.]

- 1645 **I. (£10, & Champion.<sup>1</sup>)**—**C. R. W. ADEANE**, Babraham Hall, Cambridge, born about Feb. 1.  
 1650 **II. (£5.)**—**PAGHAM HARBOUR CO.**, Selsey, Chichester, born Feb.  
 1644 **B. N. & H. C.**—**H.R.H. THE PRINCE OF WALES, K.G.**, born Feb.  
 1653 **H. C.**—**THE DUKE OF RICHMOND AND GORDON, K.G.**

**Class 186.—Southdown Shearling Rams.** [34 entries, 2 absent.]

- 1665 **I. (£15, & B. N. for Champion.<sup>1</sup>)**—**JEREMIAH COLMAN**, Gatton Park, Surrey, born Feb. 20, bred by the late **J. J. Colman**, Easton, Norwich; s. Colman's No. 22 in 1894, B.W., d. by Colman's No. 11 in 1896, 2385.  
 1655 **II. (£10.)**—**H.R.H. THE PRINCE OF WALES, K.G.**, born Feb.  
 1666 **III. (£5.)**—**GEORGE COURTAULD**, Cut Hedge, Halstead, born Feb. 16.  
 1659 **B. N. & H. C.**—**C. R. W. ADEANE**, Babraham Hall, born about Feb. 1.  
**H. C.**—**SIR JAMES BLYTH, BT.**, for No. 1661; **EARL CADOGAN, K.G.**, for No. 1662.  
 1680 **Com.**—**PAGHAM HARBOUR CO.**

**Class 187.—Pens of Three Southdown Ram Lambs.**

[13 entries, 4 absent.]

- 1690 **I. (£10.)**—**C. R. W. ADEANE**, Babraham Hall, Cambridge, born Feb.  
 1695 **II. (£5.)**—**COL. H. L. B. MCCALMONT, M.P.**, Cheveley Park, Newmarket, born Feb. 15.  
 1696 **B. N. & H. C.**—**THOMAS MILES**, Buckwell, Wye, Kent, born about Feb. 26.  
**H. C.**—**C. R. W. ADEANE**, for No. 1689; **J. COLMAN**, for No. 1691;  
**G. COURTAULD**, for No. 1692.

**Class 188.—Pens of Three Southdown Shearling Ewes, of the same Flock.** [11 entries, 3 absent.]

- 1704 **I. (£15.)**—**EARL CADOGAN, K.G.**, Culford, Bury St. Edmunds, born Feb.  
 1709 **II. (£10.)**—**PAGHAM HARBOUR CO.**, Selsey, Chichester, born Feb.

<sup>1</sup> Champion Prize of £10 10s. given by the Southdown Sheep Society for the best Southdown Ram exhibited in Classes 185 and 186.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1710 **III. (£5.)**—THE DUKE OF RICHMOND AND GORDON, K.G., Goodwood, Chichester, born Feb.  
 1708 **R. N. & H. C.**—SIR JAMES BLYTH, BT., Stansted, born Feb. 14.  
**H. C.**—J. COLMAN, for Nos. 1705 & 1706; G. COURTAULD, for No. 1707;  
**T. MILES**, for No. 1708.

**Class 189.**—*Pens of Three Southdown Ewe Lambs.*

[10 entries, 4 absent.]

- 721 **I. (£10.)**—WHITAKER WEIGHT, Lea Park, Godalming, born March 5;  
*s.s.* Colman's No. 26 in 1897, 2795 and Lea Park 3641.  
 1716 **II. (£5.)**—THE EARL OF ELLESMERE, Stetchworth Park, Newmarket,  
 born Feb.  
 1715 **R. N. & H. C.**—GEORGE COURTAULD, Cut Hedge, Halstead, born Feb. 19.  
 1718 **H. C.**—COL. MCCALMONT, M.P.

## Hampshire Downs.

**Class 190.**—*Hampshire Down Two-Shear Rams.*

[10 entries, 4 absent.]

- 1724 **I. (£10, & R. N. for Champion.<sup>1</sup>)**—CARY COLES, Manor House, Winterbourne Stoke, Salisbury, for Candidate 2866, born Jan. 21; *s.* Berry Court No. 62, 2695.  
 1726 **II. (£5.)**—JAMES FLOWER, Chilmark, Salisbury, born Jan.  
 1722 **R. N. & H. C.**—T. FOWELL BUXTON, Waters Place, Ware, born Jan.  
 1728 **H. C.**—MRS. MIDDLETON.

**Class 191.**—*Hampshire Down Shearling Rams.*

[19 entries, 3 absent.]

- 1744 **I. (£15, & Champion.<sup>1</sup>)**—LORD ROTHSCHILD, Tring Park, Herts, born about Jan. 10.  
 1739 **II. (£10.)**—JAMES FLOWER, Chilmark, Salisbury, born Jan.  
 1742 **III. (£5.)**—R. W. HUDSON, Danesfield, Great Marlow, for Danesfield 3, 3490, born Jan. 14; *s.* Folio 2959.  
 1733 **R. N. & H. C.**—T. FOWELL BUXTON, Waters Place, Ware, born Jan.  
**H. C.**—T. FOWELL BUXTON, for No. 1734; THE EARL OF CARNARVON, for No. 1735.  
**Com.**—CARY COLES, for No. 1738; JAMES FLOWER, for No. 1740;  
 R. W. HUDSON, for No. 1743; C. A. SCOTT-MURRAY, for No. 1747.

**Class 192.**—*Pens of Three Hampshire Down Ram Lambs.*

[16 entries, 4 absent.]

- 1754 **I. (£10.)**—THE EARL OF CARNARVON, Highclere Castle, Newbury, born about Jan. 14.  
 1756 **II. (£5.)**—JAMES FLOWER, Chilmark, Salisbury.  
 1751 **R. N. & H. C.**—T. FOWELL BUXTON, Waters Place, Ware, born Jan.  
**H. C.**—CARY COLES, for No. 1755; R. W. HUDSON, for No. 1761; LORD ROTHSCHILD, for No. 1762; H. C. STEPHENS, M.P., for No. 1766.  
 1759 **Com.**—BASIL HANBURY.

<sup>1</sup> Champion Prize of £20 given by the Hampshire Down Sheep Breeders' Association for the best Hampshire Down Ram exhibited in Classes 190 and 191.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

**Class 193.—Pens of Three Hampshire Down Shearling Ewes, of the same Flock.** [6 entries, none absent.]

- 1767 I. (£15.), & 1768 II. (£10.)—JAMES FLOWER, Chilmark, born Jan.  
 1770 III. (£5.)—R. W. HUDSON, Danesfield, Great Marlow, born about Jan. 14.  
 1771 B. W. & H. C.—C. A. SCOTT-MURRAY, Hambleden, born Jan. 20.  
 1772 H. C.—H. C. STEPHENS, M.P.

**Class 194.—Pens of Three Hampshire Down Ewe Lambs.**  
 [13 entries, 3 absent.]

- 1776 I. (£10.)—JAMES FLOWER, Chilmark, Salisbury, born Jan.  
 1774 II. (£5.)—THE EARL OF CARNARVON, Highclere Castle, Newbury, born about Jan. 14.  
 1775 B. W. & H. C.—CARY COLES, Winterbourne Stoke, born Jan.  
 H. C.—T. FOWELL BUXTON, for No. 1773; R. W. HUDSON, for No. 1780.  
 Com.—C. A. SCOTT-MURRAY, for No. 1783; H. C. STEPHENS, M.P., for No. 1784.

## Suffolks.

**Class 195.—Suffolk Two-Shear Rams.** [3 entries, 2 absent.]

- 1787 I. (£10, & B. W. for Champion.<sup>1</sup>)—THE EARL OF ELLESMERE, Stetchworth Park, Newmarket, born Feb.

**Class 196.—Suffolk Shearling Rams.** [9 entries, 3 absent.]

- 1793 I. (£15, & Champion<sup>1</sup>), 1791 III. (£5.), & 1792 B. W. & H. C.—THE EARL OF ELLESMERE, Stetchworth Park, Newmarket, born Feb.  
 1797 II. (£10.)—HERBERT E. SMITH, The Grange, Walton, born Feb.  
 Com.—MAJOR BAIRD, for No. 1790; T. GOODCHILD, for No. 1794.

**Class 197.—Pens of Three Suffolk Ram Lambs.**  
 [8 entries, 1 absent.]

- 1805 I. (£10.)—HERBERT E. SMITH, The Grange, Walton, born Jan. 25.  
 1799 II. (£5.)—THE EARL OF ELLESMERE, Stetchworth Park, born Feb.  
 1800 B. W. & H. C.—THOMAS GOODCHILD, Great Yeldham Hall, born Jan.  
 Com.—MAJOR BAIRD, for No. 1798; D. A. GREEN, for No. 1801;  
 COL. McCALMONT, M.P., for No. 1803; S. R. SHERWOOD, for No. 1804.

**Class 198.—Pens of Three Suffolk Shearling Ewes, of the same Flock.**  
 [3 entries.]

- 1807 I. (£15.), & 1806 II. (£10.)—THE EARL OF ELLESMERE, Stetchworth Park, Newmarket, born Feb.  
 1808 B. W. & H. C.—HERBERT E. SMITH, The Grange, Walton, born Feb.

**Class 199.—Pens of Three Suffolk Ewe Lambs.**  
 [9 entries, 1 absent.]

- 1815 I. (£10.)—S. R. SHERWOOD, Playford, Ipswich, born Jan.  
 1817 II. (£5.)—HERBERT E. SMITH, The Grange, Walton, born Jan. 25.

<sup>1</sup> Champion Gold Medal given by the Suffolk Sheep Society for the best Suffolk Ram exhibited in Classes 195 and 196.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

1812 **B. N. & H. C.**—D. A. GREEN, Fingringhoe Hall, Colchester, born Jan.

1811 **H. C.**—THOMAS GOODCHILD.

**Com.**—MAJOR BAIRD, for No. 1809; THE EARL OF ELLESMERE, for No. 1810; COL. McCALMONT, M.P., for No. 1814; S. R. SHERWOOD, for No. 1816.

## Border Leicesters.

### Class 200.—*Border Leicester Two-Shear Rams.*<sup>1</sup>

[11 entries, none absent.]

1819 **I. (£10.)**—THE RT. HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk, N.B., born March.

1820 **II. (£5.)**—WILLIAM BELL, St. Martin's Terrace, Brampton, Cumberland, for Auctioneer, born March 10, bred by J. Annandale & Sons, Lintz Green, Newcastle-on-Tyne; s. Percy 1897, d. by Haymount 1891.

1821 **B. N. & H. C.**—JOHN BEST, Polmont, N.B., for Longniddry Princes.

1826 **H. C.**—THOMAS WINTER.

**Com.**—THE RT. HON. A. J. BALFOUR, M.P., for No. 1818; ROBERT TAYLOR, for No. 1824; THOMAS WINTER, for No. 1827.

### Class 1.—*Border Leicester Shearling Rams.*

[20 entries, 3 absent.]

1829 **I. (£15.)**—THE RT. HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk, N.B., born March.

1837 **II. (£10.)**—J. E. NICHOLSON, Manor House, Lanchester, co. Durham, born March 20; s. Matt.

1836 **III. (£5.)**—J. E. NICHOLSON, born March 29; s. Mayor of Maidstone.

1841 **B. N. & H. C.**—JOHN TWENTYMAN, Wigton, born March 2.

**H. C.**—J. JAMES, for No. 1833; T. MCINTOSH, for No. 1834; JOHN TWENTYMAN, for No. 1843.

**Com.**—THE RT. HON. A. J. BALFOUR, M.P., for No. 1830; T. MCINTOSH, for No. 1835.

### Class 202.—*Pens of Three Border Leicester Ram Lambs.* [6 entries.]

1853 **I. (£10.)**—JOHN TWENTYMAN, Hawkrigg House, Wigton, born March.

1851 **II. (£5.)**—THOMAS MCINTOSH, Brechin, N.B., born March 12.

1852 **B. N. & H. C.**—J. E. NICHOLSON, born March 10 and 12.

**Com.**—THE RT. HON. A. J. BALFOUR, M.P., for No. 1849; J. JAMES, for No. 1850; W. H. & J. WINTER, for No. 1854.

### Class 203.—*Pens of Three Border Leicester Shearling Ewes, of the same Flock.* [9 entries, 1 absent.]

1855 **I. (£15.)**—THE RT. HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk, N.B., born March.

1860 **II. (£10.)**—ROBERT TAYLOR, Pitlivie Farm, Carnoustie, N.B., born about March 20; s. Royal Winner 280.

1857 **III. (£5.)**—THOMAS MCINTOSH, Brechin, N.B., born March 15.

1862 **B. N. & H. C.**—THOMAS WINTER, Aberford, Leeds, born March.

1858 **H. C.**—J. E. NICHOLSON. 1856 **Com.**—J. W. HALL.

### Class 204.—*Pens of Three Border Leicester Ewe Lambs.* [7 entries.]

1866 **I. (£10.)**—THOMAS MCINTOSH, Brechin, N.B., born March 15.

1864 **II. (£5.)**—THE RT. HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk, N.B., born March.

<sup>1</sup> Prizes given by the York Local Committee.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

- 1867 **B. N. & H. C.**—J. E. NICHOLSON, Manor House, Lanchester, born March.  
 1868 **H. C.**—JOSEPH JAMES.  
**Com.**—JOHN TWENTYMAN, for No. 1868; THOMAS WINTER, for No. 1869; W. H. & J. WINTER, for No. 1870.

## Wensleydales.

### Class 205.—*Wensleydale Two-Shear Rams.*<sup>1</sup> [7 entries, 1 absent.]

- 1876 **I.** (£15, & Champion.<sup>2</sup>)—THE EXORS. OF THE LATE T. WILLIS, Manor House, Carperby, Aysgarth, for Royal Maidstone, born March, bred by the late J. H. Calvert, Sunnyside, Masham; *s.* Choice, *d.* by Eton.  
 1872 **II.** (£10, & **R. N.** for Champion.<sup>2</sup>)—WM. CLEASBY, Islebeck Grange, Thirsk, for Golden 1900, born March 23; *s.* Carperby Fancy 598, *d.* by Maltster 529.  
 1875 **III.** (£5.)—JAMES RHODES, Stockeld, Wetherby, bred by T. Theakston, Masham; *s.* Royal Darlington 631.  
 1877 **B. N. & H. C.**—THE EXORS. OF THE LATE T. WILLIS, Carperby, for Royal Record.

### Class 206.—*Wensleydale Shearling Rams.* [10 entries, 1 absent.]

- 1887 **I.** (£15.)—THE EXORS. OF THE LATE T. WILLIS, Manor House, Carperby, Aysgarth, Yorks, born March, bred by W. Rhodes, Lundholme, Westhouse, Kirkby Lonsdale; *s.* Marengo 499, *d.* by Erl King 382.  
 1882 **II.** (£10.)—JAMES RHODES, Stockeld, born March 9; *s.* Rightboy 702.  
 1879 **III.** (£5.)—WM. CLEASBY, Islebeck Grange, Thirsk, born March 21; *s.* Carperby Fancy 598, *d.* by Wensleydale Surprise 380.  
 1883 **B. N. & H. C.**—JAMES RHODES, Stockeld, born March 12.

### Class 207.—*Pens of Three Wensleydale Ram Lambs.* [5 entries, none absent.]

- 1888 **I.** (£10.)—LADY HENRY BENTINCK, Underley Hall, Kirkby Lonsdale, born Feb. and March; *s.* Winder 523.  
 1889 **II.** (£5.)—JAMES RHODES, Stockeld, Wetherby, born March 12 to 22; *ss.* Gamester 677 and Rightboy 702.  
 1891 **B. N. & H. C.**—T. THOMPSON, Lancaster, born Feb. and March.

### Class 208.—*Pens of Three Wensleydale Shearling Ewes, of the same Flock.* [8 entries, 1 absent.]

- 1900 **I.** (£15.)—THE EXORS. OF THE LATE T. WILLIS, Manor House, Carperby Aysgarth, Yorks, born March; *s.* Omega 506, *ds.* by Confidence 292 and Lord of the Valley 109.  
 1896 **II.** (£10.)—JAMES RHODES, Stockeld, Wetherby, born March; *ss.* Gamester 677 and Rightboy 702.  
 1893 **III.** (£5.)—LADY HENRY BENTINCK, Underley Hall, Kirkby Lonsdale, born March and April; *s.* Winder 523.  
 1895 **B. N. & H. C.**—WM. CLEASBY, Thirsk, born about March 23.

### Class 209.—*Pens of Three Wensleydale Ewe Lambs.*<sup>1</sup> [5 entries, none absent.]

- 1905 **I.** (£10.)—THE EXORS. OF THE LATE T. WILLIS, Manor House, Carperby, Aysgarth, Yorks, born March and April; *s.* Royal Maidstone, *d.* by Sensation 353.

<sup>1</sup> Prizes given by the York Local Committee.

<sup>2</sup> Champion Prize of £10, given by the Wensleydale Blue-Faced Sheep Breeders' Association, for the best Wensleydale Ram exhibited in Classes 205 and 206.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

1901 II. (£5).—LADY HENRY BENTINCK, Underley Hall, Kirkby Lonsdale, born Feb.; s. Winder 523.

1902 R. N. & H. C.—JAMES RHODES, Stockeld, Wetherby, born March.

### Kentish or Romney Marsh.

**Class 210.**—*Kentish or Romney Marsh Shearling Rams.*

[11 entries, 1 absent.]

1913 I. (£10).—FREDERICK NEAME, Macknade, Faversham, born March 18.

1908 II. (£5).—ALFRED AMOS, Spring Grove, Wye, for Amos 38, born March 10.

1912 R. N. & H. C.—WM. MILLEN, Syndale Valley, Faversham, born Apr. 2.

**Class 211.**—*Pens of Three Kentish or Romney Marsh Shearling Ewes, of the same Flock.* [7 entries, none absent.]

1919 I. (£10).—WM. MILLEN, Syndale Valley, Faversham, born in March.

1920 II. (£5).—WM. MILLEN, Faversham, born about April 5.

1922 R. N. & H. C.—F. NEAME, Macknade, Faversham, born March 18.

1917 Com.—CHARLES FILE.

### Devon Long-Woolled.

**Class 212.**—*Devon Long-Woolled Two-Shear or Shearling Rams.*

[6 entries, 3 absent.]

1928 I. (£10).—F. WHITE, Torweston, Williton, Som., born Feb. 1898.

1929 II. (£5).—FREDERICK WHITE, Williton, born Feb. 1899.

1924 R. N. & H. C.—R. COOK, Chevithorne Barton, Tiverton, born Feb. 1898.

**Class 213.**—*Pens of Three Devon Long-Woolled Shearling Ewes, of the Same Flock.* [2 entries.]

1930 I. (£10).—ROBERT COOK, Chevithorne Barton, Tiverton, born Feb.

1931 II (£5).—FREDERICK WHITE, Torweston, Williton, Somerset, born Feb.

### Somerset and Dorset Horned.

**Class 214.**—*Somerset and Dorset Horned Shearling Rams, dropped after November 1, 1898.* [2 entries.]

1932 I. (£10).—WILLIAM REGINALD FLOWER, West Stafford, Dorchester, for Flower's No. 64 1107, born Nov. 20, 1898; s. Flower's No. 55 1020, d. by Flower's No. 42 674.

1933 II. (£5).—WILLIAM REGINALD FLOWER, for Flower's No. 70 1179, born Dec. 22, 1898; s. Flower's No. 45 682, d. by Ninehead No. 4.

**Class 215.**—*Pens of Three Somerset and Dorset Horned Shearling Ewes, of the same Flock, dropped after November 1, 1898.* [4 entries.]

1935 I. (£10).—LEONARD C. ATTRILL, Bowcombe Farm, Carisbrooke, Isle of Wight, born Nov. and Dec. 1898; ss. Boxer 918 and Farthing 991.

1936 II. (£5).—WILLIAM REGINALD FLOWER, West Stafford, Dorchester, born Nov. 20, 1898; s. Flower's No. 55 1020.

1934 R. N. & H. C.—L. C. ATTRILL, born in Nov. and Dec. 1898.

1937 Com.—WILLIAM REGINALD FLOWER.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## **Cheviots.**

### **Class 216.**—*Cheviot Rams, Two-Shear and upwards.*

[6 entries, none absent.]

- 1938 I. (£10.), & 1939 Com.—JOHN ELLIOT, Hindhope, Jedburgh, N.B., born April 15, 1898.  
1942 II. (£5.), & 1943 R. N. & H. C.—JOHN ROBSON, Newton, Bellingham, Northumberland, born April, 1898.

### **Class 217.**—*Cheviot Shearling Rams.* [6 entries, none absent.]

- 1944 I. (£10.), & 1945 R. N. & H. C.—JOHN ELLIOT, Hindhope, Jedburgh, N.B., born April 15.  
1948 II. (£5.)—JOHN ROBSON, Newton, Bellingham, born April.  
1946 Com.—JACOB ROBSON.

### **Class 218.**—*Pens of Three Cheviot Shearling Ewes, of the same Flock.* [5 entries, none absent.]

- 1953 I. (£10.), & 1954 II. (£5.)—JOHN ROBSON, Bellingham, born April.  
1950 R. N. & H. C.—JOHN ELLIOT, Hindhope, Jedburgh, N.B., born April 15.  
1951 Com.—JACOB ROBSON.

## **Black-Faced Mountain.**

### **Class 219.**—*Black-Faced Mountain Rams, Two-Shear and upwards.* [7 entries, 1 absent.]

- 1956 I. (£10.)—THE EXORS OF THE LATE T. DARGUE, Burnside Hall, Kendal, born about Apr. 20, 1898, bred by Mr. Fleming, Threepland, N.B.  
1958 II. (£5.)—THOMAS RAWLINSON, Park House, Kirkby Lonsdale, for Hector MacDonald, born Apr. 16, 1898; s. Avon's Model, d. by Fifty-one.  
1961 R. N. & H. C.—JOS. VICKERS, Elm Park, Tow Law, for Mountain Top.  
1957 H. C.—DONALD T. MARTIN.

### **Class 220.**—*Black-Faced Mountain Shearling Rams.* [9 entries, none absent.]

- 1964 I. (£10.)—THE EXORS OF THE LATE T. DARGUE, Burnside Hall, Kendal, born April 24; s. Young Density.  
1969 II. (£5.)—JOSEPH VICKERS, Elm Park, Tow Law, co. Durham, born April; s. Goldsmith.  
1963 R. N. & H. C.—CRAWFORD BROS., Cartington, Bothbury, born April 20.  
1967 H. C.—THOMAS RAWLINSON.

### **Class 221.**—*Pens of Three Black-Faced Mountain Shearling Ewes, of the same Flock.* [7 entries, none absent.]

- 1977 I. (£10.), & 1976 II. (£5.)—JOSEPH VICKERS, Elm Park, Tow Law, co. Durham, born April; s. Goldsmith.  
1972 R. N. & H. C.—THE EXORS OF THE LATE T. DARGUE, born in April.  
1973 H. C.—DONALD T. MARTIN.

[Unless otherwise stated, each prize animal named below was "bred by exhibitor."]

## Herdwicks.

### **Class 222.**—*Herdwick Rams, Two-Shear and upwards.*

[3 entries, 2 absent.]

- 1980 I. (£10.)—JOHN ROTHERY, Palace Howe, Cockermouth, for Robinson, born April 4, 1898; s. Lindow, d. by Prime Minister.

### **Class 223.**—*Pens of Three Herdwick Shearling Ewes, of the same Flock.* [3 entries, 1 absent.]

- 1982 I. (£10.), & 1983 II. (£5.)—S. D. STANLEY-DODGSON, Tarnbank, Cockermouth, born April, bred by Exhibitor and Wm. Abbott, Hartsop Hall, Patterdale, Penrith.

## Welsh Mountain.

### **Class 224.**—*Welsh Mountain Rams, Two-Shear and upwards.*

[8 entries, 1 absent.]

- 1986 I. (£10.)—J. MARSHALL DUGDALE, Llwyn, Llanfyllin, Mont., for Hero 2nd, born March, 1897; s. Hero 1st.  
 1984 II. (£5.)—W. CONWY BELL, Bryn-y-fynon, Rhuddlan, Flint, for Cymro Dewr, born March, 1898; s. Y'Cymro-Goren.  
 1990 B. N. & H. C.—WM. LEATHES, Wern Fawr, Ruthin, born March 16, 1898.  
 1987 H. C.—J. MARSHALL DUGDALE. 1988 Com.—R. M. GREAVES.

### **Class 225.**—*Pens of Three Welsh Mountain Shearling Ewes, of the same Flock.* [6 entries, 1 absent.]

- 1995 I. (£10.)—MRS. ANNE GRATTON, Forydd Fawr Farm, Abergale, N. Wales, born Feb. 3 and 10, and March 6.  
 1992 II. (£5.)—W. CONWY BELL, Bryn-y-fynon, Rhuddlan, Flint, born March; s. Y'Cymro-Goren.  
 1993 B. N. & H. C., & 1994 H. C.—J. MARSHALL DUGDALE, born March.

## PIGS.

[Classes 226 to 247.]

### *Extract from the Report of the Council to the Anniversary General Meeting of Members of the Society, held on May 22, 1900 :*

"The Council had contemplated, as usual, an exhibition of Pigs in connection with this year's Meeting, and had included the customary classes for Pigs in the Prize-sheet. On January 26 last, however, the City of York was, by an Order of the Board of Agriculture, declared a 'Swine Fever Infected Area,' and that Order is still in force. The Council have considered the situation thus created on several occasions since January; but as from the latest information received by the Society there appeared no probability of the present restrictions being removed at an early date, the Council, acting upon the opinion of the Society's Veterinary Advisers, felt there was no alternative but to abandon with regret any exhibition of Pigs this year."

## POULTRY.

By "Cock," "Hen," "Drake," "Duck," "Gander," and "Goose" are meant birds hatched previous to January 1st, 1900.

By "Cockerel," "Pullet," "Young Drake," and "Duckling" are meant birds hatched in 1900, previous to June 1st.

## FOWLS.

## Game.

**Class 248.—Old English Game Cocks.**

[12 entries, none absent.]

2000 I. (30s.)—W. H. LEWIS, Green Meadow, Treorchy, Glam. April 20, 1898.

1999 II. (15s.)—W. H. LEWIS, Treorchy. April 24, 1899.

2006 III. (10s.)—W. PROUD, Talkin, Brampton Junction. May 1, 1899.

2001 E. N. & H. C.—ISAAC W. MESSENGER, Hensingham, Whitehaven.

H. C.—THOMAS FORSTER, for No. 1998; W. PARKER, for No. 2004.

**Class 249.—Old English Game Hens.** [10 entries, 1 absent.]

2011 I. (30s.)—ISAAC W. MESSENGER, Hensingham, Whitehaven. 1898.

2012 II. (15s.)—WM. NIXON, Boustead Hill, Burgh-by-Sands. May, 1898.

2019 III. (10s.)—C. W. WILSON, The Gale, Abbey Town. April 8, 1898.

2010 E. N. & H. C.—W. H. LEWIS, Green Meadow, Treorchy, Glamorgan.

2014 H. C.—WILLIAM PARKER.

**Class 250.—Old English Game Cockerels.** [5 entries, none absent.]

2022 I. (30s.)—ISAAC W. MESSENGER, Hensingham, Whitehaven. Jan.

2024 II. (15s.)—C. W. WILSON, The Gale, Abbey Town. Jan. 2.

2020 III. (10s.)—THOMAS GARNER, Abbey Town, Cumberland. Jan. 4.

2023 E. N.—ANTHONY B. SHEPARD, Haverigg, Millom, Cumb.

**Class 251.—Old English Game Pullets.** [8 entries, none absent.]

2028 I. (30s.)—W. HARKER, Salt House Farm, Millom, Cumberland. Jan. 16.

2032 II. (15s.)—C. W. WILSON, The Gale, Abbey Town. Jan. 2.

2025 III. (10s.)—P. A. FISHER, Carhead, Crosshills, Keighley. Jan. 13.

2027 E. N.—THOMAS GARNER, Abbey Town, Cumberland.

**Class 252.—Indian Game Cocks.** [5 entries.]

2034 I. (30s.)—WM. BRENT, Clampit, Linkinhorne, Callington, Cornwall.

2035 II. (15s.)—W. H. CRANE, Great Barr Hall, near Birmingham.

2033 III. (10s.)—H. ANNINGSOON, Humberstone, Grimsby. March 12, 1899.

2037 E. N. & H. C.—EDWIN STRIKE, Hawk's Tor View, Launceston.

2036 H. C.—JAMES FRAYNE.

**Class 253.—Indian Game Hens.** [10 entries, 3 absent.]

2046 I. (30s.)—EDWIN STRIKE, Hawk's Tor View, Launceston.

2039 II. (15s.)—WM. BRENT, Clampit, Linkinhorne, Callington, Cornwall. 1897.

2044 III. (10s.)—T. W. FUTCHER, Oulton, Leeds.

2038 E. N. & H. C.—H. ANNINGSOON, Humberstone, Grimsby. March 10, 1898.

2043 H. C.—JAMES FRAYNE.

**Class 254.—Indian Game Cockerels.** [5 entries, 1 absent.]

2050 I. (30s.)—JAMES FRAYNE, Piper's Pool, Egloskerry, R.S.O., Cornwall.

2048 II. (15s.)—W. BRENT, Clampit, Linkinhorne, Callington, Cornwall.

2051 III. (10s.)—EDWIN STRIKE, Hawk's Tor View, Launceston.

**Class 255.—Indian Game Pullets. [6 entries.]**

- 2056 I. (30s.)—J. N. JACKMAN, Burnville, Tavistock, Devon. Jan. 3.  
 2057 II. (15s.)—C. RADFORD, Barnstaple Street, Winkleigh, Devon. Jan. 5.  
 2055 III. (10s.)—JAMES FRAYNE, Piper's Pool, Egloskerry, R.S.O., Cornwall.  
 2054 E. N. & H. C.—JOHN FRAYN, St. Stephens, Launceston, Cornwall.  
 H. C.—WILLIAM BRENT, for No. 2053; EDWIN STRIKE, for No. 2058.

**Dorkings.****Class 256.—Coloured Dorking Cocks. [8 entries, none absent.]**

- 2061 I. (30s.)—T. CRICHTON, Shawdon Estates Office, Alnwick. 1898.  
 2066 II. (15s.)—HERBERT REEVES, Northlands, Emsworth, Hants.  
 2059 III. (10s.)—J. T. CATHCART, Dunbog House, Newburgh, Fife, N.B.  
 2064 E. N. & H. C.—JOHN GILLIES, Edington Mills, Chirnside, Berwickshire.  
 H. C.—R. W. CRESWELL-WARD, for No. 2060; HENRY MEREDITH, for No. 2065.  
 2062 Com.—VISCOUNT DEERHURST.

**Class 257.—Coloured Dorking Hens. [8 entries, none absent.]**

- 2067 I. (30s.)—J. T. CATHCART, Dunbog, Newburgh, Fife, N.B.  
 2059 II. (15s.)—ROBERT FITTON, Ribby Hall, Kirkham, Lancs.  
 2068 III. (10s.)—VISCOUNT DEERHURST, Birlingham House, Pershore. 1898.  
 2073 E. N. & H. C.—HERBERT REEVES, Northlands, Emsworth, Hants.  
 H. C.—JOHN MEIKLE, for No. 2071; A. T. & H. PEARs, for No. 2072.  
 2070 Com.—JOHN GILLIES.

**Class 258.—Coloured Dorking Cockerels. [8 entries, 1 absent.]**

- 2081 I. (30s.), & 2082 II. (15s.)—HERBERT REEVES, Northlands, Emsworth.  
 2078 III. (10s.)—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. Jan. 3.  
 2075 E. N. & H. C.—T. BROCKLEBANK, The Roscote, Heswall, Ches. Jan. 6  
 Com.—CAPT. G. PHIPPS HORNBY, for No. 2079; A. T. & H. PEARs, for No. 2080.

**Class 259.—Coloured Dorking Pullets. [12 entries, 2 absent.]**

- 2087 I. (30s.)—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. Jan. 3.  
 2083 II. (15s.)—T. BROCKLEBANK, The Roscote, Heswall, Cheshire. Jan. 6.  
 2088 III. (10s.)—CAPT. G. PHIPPS HORNBY, Sandley Ho., Gillingham. Jan. 7.  
 2092 E. N. & H. C.—HERBERT REEVES, Northlands, Emsworth, Hants. Jan. 2.  
 H. C.—HERBERT REEVES, for No. 2091; JOHN WHITE, for No. 2093.  
 2094 Com.—JOHN WHITE.

**Class 260.—Silver Grey Dorking Cocks. [8 entries, 1 absent.]**

- 2101 I. (30s.)—ARTHUR E. WARD, Ivy Lea, Sale, Chester. March 23, 1898.  
 2097 II. (15s.), & 2098 III. (10s.)—ROBERT FITTON, Ribby Hall, Kirkham.  
 2095 E. N. & H. C.—HON. FLORENCE AMHERST, Didlington Hall, Brandon.  
 Com.—J. MECHIE, Jun. for No. 2099; COL. S. SANDBACH, for No. 2100.

**Class 261.—Silver Grey Dorking Hens. [8 entries, 1 absent.]**

- 2104 I. (30s.)—HON. FLORENCE AMHERST, Didlington Hall, Brandon.  
 2106 II. (15s.), & 2105 III. (10s.)—ROBERT FITTON, Ribby Hall, Kirkham.  
 2109 E. N. & H. C.—THOMAS RAE, Craighlaw, Kirkcowan, Wigtownshire.  
 2110 H. C.—HERBERT REEVES.  
 Com.—JOHN MECHIE, Jun., for No. 2107; H. MEREDITH, for No. 2108.

**Class 262.—Silver Grey Dorking Cockerels.** [9 entries, 1 absent.]

- 2119 I. (30s.) & 2118 III. (10s.)—HERBERT REEVES, Northlands, Emsworth.  
 2114 II. (15s.)—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. Jan. 3.  
 2115 B. N. & H. C.—CAPT. G. PHIPPS HORNBY, Sandley House, Gillingham.  
 H. C.—ROBERT FITTON, for No. 2113; JOHN LAING, for No. 2116.

**Class 263.—Silver Grey Dorking Pullets.** [9 entries, none absent.]

- 2128 I. (30s.)—HERBERT REEVES, Northlands, Emsworth, Hants. Jan. 2.  
 2121 II. (15s.)—CHAS. AITKENHEAD, Stud Farm, Seaham Harbour. Jan. 5.  
 2123 III. (10s.)—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. Jan. 3.  
 2125 B. N. & H. C.—CAPT. G. PHIPPS HORNBY, Sandley House, Gillingham.  
 2122 H. C.—HON. FLORENCE AMHERST.  
 Com.—JOHN LAING, for No. 2126; JOHN MEIKLE, for No. 2127.

**Class 264.—White or Cuckoo Dorking Cocks or Cockerels.**  
[No entry.]**Class 265.—White or Cuckoo Dorking Hens or Pullets.**  
[No entry.]**Brahmas and Cochins.****Class 266.—Brahma Cocks.** [10 entries, none absent.]

- 2137 I. (30s.)—ARTHUR E. WARD, Ivy Lea, Sale, Chester. June, 1897.  
 2131 II. (15s.), 2133 B. N. & H. C., & 2132 Com.—G. W. HENSHALL, Field House, Urmston, Manchester. 1898.  
 2138 III. (10s.)—ARTHUR E. WARD, Sale. Feb., 1898.  
 2136 H. C.—S. W. THOMAS.

**Class 267.—Brahma Hens.** [6 entries, none absent.]

- 2139 I. (30s.)—JOHN GILLIES, Edington Mills, Chirnside, Berwickshire.  
 2140 II. (15s.), & 2141 III. (10s.)—G. W. HENSHALL, Field House, Urmston, Manchester. 1898.  
 2142 B. N. & H. C.—R. HOLLAND, Brahma Lodge, Buckingham. 1898.  
 2144 Com.—ARTHUR E. WARD.

**Class 268.—Cochin Cocks.** [7 entries, 1 absent.]

- 2148 I. (30s.)—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
 2151 II. (15s.)—J. ANDREWS SLATTER, Hill House, Somerton, Banbury.  
 2149 III. (10s.)—H. PICKLES, Kayfield House, Earby, Colne.  
 2150 B. N. & H. C.—GEORGE H. PROCTER, Flass House, Durham. 1899.  
 2147 H. C.—ROBERT H. LINGWOOD.

**Class 269.—Cochin Hens.** [5 entries, none absent.]

- 2152 I. (30s.)—R. HOLLAND, Brahma Lodge, Buckingham. 1898.  
 2153 II. (15s.)—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
 2154 III. (10s.)—H. PICKLES, Kayfield House, Earby, Colne.  
 2155 B. N. & H. C.—GEORGE H. PROCTER, Flass House, Durham. 1898.

**Class 270.—Brahma or Cochinchina Cockerels.** [2 entries.]

- 2157 II. (15s.)—R. HOLLAND, Brahma Lodge, Buckingham. (Brahma.)  
 2158 III. (10s.)—J. A. SLATTER, Hill House, Somerton, Banbury. (Cochin.)

**Class 271.—Brahma or Cochinchina Pullets.** [3 entries.]

- 2161 I. (30s.)—J. A. SLATTER, Hill House, Somerton, Banbury. (Brahma.)  
 2159 II. (15s.)—R. HOLLAND, Brahma Lodge, Buckingham. (Brahma.)  
 2160 III. (10s.)—R. H. LINGWOOD, Needham Market. (Cochin.)

**Langshans.****Class 272.—Langshan Cocks.** [7 entries, none absent.]

- 2168 I. (30s.).—BERKELEY D. WISE, Greenisland, Belfast. Mar. 1899.  
 2165 II. (15s.).—W. H. CRANE, Great Barr Hall, nr. Birmingham.  
 2164 III. (10s.).—W. L. COLE, Stansted, Emsworth, Hants. March 20, 1899.  
 2166 B. N. & H. C.—F. O. & H. M. PIERCY, The Elms, Lowthorpe, Yorks.  
 H. C.—T. J. ALTY, for No. 2162; MRS. A. M. WATTS, for No. 2167.

**Class 273.—Langshan Hens.** [7 entries, none absent.]

- 2172 I. (30s.).—R. H. CREIGHTON, Ballyshannon, co. Donegal. May 21, 1899.  
 2173 II. (15s.).—F. O. & H. M. PIERCY, The Elms, Lowthorpe, Yorks. Apr., 1898.  
 2174 III. (10s.).—MRS. A. M. WATTS, 1 North Street, Wellingborough.  
 2175 B. N. & H. C.—R. S. WILLIAMSON, Cannock Wood House, Hednesford.  
 H. C.—W. L. COLE, for No. 2169.

**Class 274.—Langshan Cockerels.** [6 entries, none absent.]

- 2176 I. (30s.).—ABBOT BROS., Thuxton, Norfolk. Jan.  
 2181 II. (15s.). & 2180 B. N. & H. C.—HON. MARY HAWKE, Wighill Park, Tadcaster. Jan. 3.  
 2179 III. (10s.).—M. G. GOLDSMITH, Blendworth, Horndean, Hants. Jan. 4.  
 2178 H. C.—C. I. BARNETT.

**Class 275.—Langshan Pullets.** [10 entries, none absent.]

- 2189 I. (30s.).—JONATHAN HILL, Bridgend Mills, Lostwithiel, Cornwall.  
 2183 II. (15s.).—T. J. ALTY, Vine Cottage, Pilling, near Garstang. Jan. 3.  
 2186 III. (10s.).—M. G. GOLDSMITH, Blendworth, Horndean, Hants. Jan. 4.  
 2185 B. N. & H. C.—C. I. BARNETT, Mill End, Henley-on-Thames. Jan. 14.  
 2190 H. C.—MAYALL & SIKES.

**Plymouth Rocks.****Class 276.—Plymouth Rock Cocks.** [12 entries, 1 absent.]

- 2201 I. (30s.).—ARTHUR THOMAS, Brownslade, Pembroke. April, 1899.  
 2199 II. (15s.).—HENRY PINCHBECK, The Elms, Burton-on-Trent. 1899.  
 2194 III. (10s.).—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. April, 1899.  
 2193 B. N. & H. C.—JESSE COE, Rock Lodge, Desborough, Northampton.  
 H. C.—E. W. ALLONBY, for No. 2192; MRS. JACKSON, for No. 2196;  
 BERKELEY D. WISE, for No. 2202.

**Class 277.—Plymouth Rock Hens.** [7 entries, none absent.]

- 2205 I. (30s.).—MRS. JACKSON, The Limes, Silverdale, Lancs.  
 2208 II. (15s.).—HENRY PINCHBECK, The Elms, Burton-on-Trent. 1898.  
 2210 III. (10s.).—MRS. H. TURNER, Elmdale, Stechford, near Birmingham.  
 2207 B. N. & H. C.—FRANK NEAVE, Lingwood, Norwich.  
 H. C.—J. W. HALL, for No. 2204; MRS. JACKSON, for No. 2206.

**Class 278.—Plymouth Rock Cockerels.** [17 entries, 2 absent.]

- 2221 I. (30s.), & 2222 III. (10s.).—MRS. JACKSON, The Limes, Silverdale.  
 2213 II. (15s.).—JAS. & C. E. BATEMAN, Firbank, Sedburgh, R.S.O., Yorks.  
 2211 B. N. & H. C.—ABBOT BROS., Thuxton, Norfolk. Jan.  
 H. C.—SAMUEL DONKIN, for Nos. 2216 & 2217; ROBERT FITTON, for 2218; J. R. P. LEGH, for No. 2223.

**Class 279.—Plymouth Rock Pullets.** [22 entries, 2 absent.]

- 2239 I. (30s.), & 2240 II. (15s.).—MRS. JACKSON, The Limes, Silverdale.  
 2236 III. (10s.).—ROBERT FITTON, Ribby Hall, Kirkham, Lancs. Jan. 3.

- 2229 **B. N. & H. C.**—**ABBOT BROS.**, Thuxton, Norfolk. Jan.  
**H. C.**—**T. H. BARGH**, for No. 2230; **JESSE COE**, for No. 2234; **J. W. HALL**, for No. 2237; **MRS. JACKSON**, for No. 2241; **J. R. P. LEGH**, for No. 2242; **EDMUND SHEBBATT**, for No. 2246; **WILLIAM SLATER**, for 2247; **ALEX. M. WILSON**, for No. 2249.

## Wyandottes.

### Class 280.—*Silver Laced Wyandotte Cocks.*

[7 entries, none absent.]

- 2254 **I. (30s.)**—**CHARLES PRESTON**, Manor House, Earlsheaton, nr. Dewsbury.  
 2253 **II. (15s.)**—**H. PICKLES**, Kayfield House, Earby, Colne.  
 2256 **III. (10s.)**—**R. R. WHITFIELD**, Rodidge Farm, Fradley, Lichfield, Staffs.  
 2250 **B. N. & H. C.**—**ABBOT BROS.**, Thuxton, Norfolk. 1899.

### Class 281.—*Silver Laced Wyandotte Hens.* [6 entries, none absent.]

- 2262 **I. (30s.)**—**J. H. & W. P. WRIGHT**, Sunny Bank, Orrell Post, Wigan.  
 2257 **II. (15s.)**—**ABBOT BROS.**, Thuxton, Norfolk. 1899.  
 2259 **III. (10s.)**, & 2258 **B. N. & H. C.**—**MRS. FRANKLIN**, Syston Old Hall, Grantham. 1899.

### Class 282.—*Silver Laced Wyandotte Cockerels.*

[5 entries, none absent.]

- 2266 **I. (30s.)**—**FRANK NEAVE**, Lingwood, Norwich. Jan.  
 2263 **II. (15s.)**—**ABBOT BROS.**, Thuxton, Norfolk. Jan.  
 2267 **III. (10s.)**—**J. H. & W. P. WRIGHT**, Sunny Bank, Orrell Post, Wigan.  
 2264 **B. N.**—**HERBERT J. BLACKLOCKS**, Sycamores, Lydd, Kent. Jan.

### Class 283.—*Silver Laced Wyandotte Pullets.*

[8 entries, none absent.]

- 2273 **I. (30s.)**—**FRANK NEAVE**, Lingwood, Norwich. Jan.  
 2274 **II. (15s.)**—**CHARLES PRESTON**, Manor House, Earlsheaton, Dewsbury.  
 2268 **III. (10s.)**—**ABBOT BROS.**, Thuxton, Norfolk. Jan.  
 2275 **B. N. & H. C.**—**J. H. & W. P. WRIGHT**, Sunny Bank, Orrell Post, Wigan.  
 2269 **H. C.**—**HERBERT J. BLACKLOCKS**.

### Class 284.—*Gold Laced Wyandotte Cocks.*

[12 entries, 1 absent.]

- 2278 **I. (30s.)**—**ROBERT FITTON**, Ribby Hall, Kirkham, Lancs. 1899.  
 2284 **II. (15s.)**, & 2283 **B. N. & H. C.**—**MRS. PIERSON**, Morley Rectory, Wymondham, Norfolk. 1899.  
 2287 **III. (10s.)**—**J. WALLIS TITT**, Woodcock House, Warminster. 1899.  
**H. C.**—**ABBOT BROS.**, for No. 2276; **THOMAS SUGDEN**, for No. 2286.

### Class 285.—*Gold Laced Wyandotte Hens.* [6 entries, 1 absent.]

- 2291 **I. (30s.)**—**CHARLES PRESTON**, Manor House, Earlsheaton, near Dewsbury.  
 2293 **II. (15s.)**—**J. WALLIS TITT**, Woodcock House, Warminster. 1899.  
 2292 **III. (10s.)**—**THOMAS SUGDEN**, Withnell, near Chorley. May, 1899.  
 2289 **B. N. & H. C.**—**JACKSON BROS.**, Cringle Brook, Goosnargh, near Preston.

### Class 286.—*Gold Laced Wyandotte Cockerels.* [8 entries, 2 absent.]

- 2296 **I. (30s.)**, & 2297 **II. (15s.)**—**M. G. GOLDSMITH**, Blendworth, Horndean.  
 2299 **III. (10s.)**—**JACKSON BROS.**, Cringle Brook, Goosnargh, near Preston.  
 2298 **B. N. & H. C.**—**S. P. HAYWARD**, Doebank, Sutton Coldfield. Jan. 8.

### Class 287.—*Gold Laced Wyandotte Pullets.* [4 entries, 1 absent.]

- 2304 **II. (15s.)**—**JACKSON BROS.**, Cringle Brook, Goosnargh, near Preston.  
 2305 **III. (10s.)**—**MRS. PIERSON**, Morley Rectory, Wymondham, Norfolk. Jan.

**Class 288.—Wyandotte Cocks or Cockerels, any other variety.**  
[7 entries, 1 absent.]

- 2312 I. (30s.)—J. WHARTON, Honeycott, Hawes, Yorks. (Partridge.)  
2311 II. (15s.)—CHARLES PRESTON, Manor House, Earlsheaton, Dewsbury.  
2310 III. (10s.)—J. G. MORTEN, Derby Fields, Spondon, Derby. (Buff.)  
2306 B. N. & H. C.—JAS. & C. E. BATEMAN, Sedbergh, R.S.O. (Buff.)

**Class 289.—Wyandotte Hens or Pullets, any other variety.**  
[8 entries, 1 absent.]

- 2319 I. (30s.)—JOHN WHARTON, Honeycott, Hawes, Yorks. (Partridge.)  
2320 II. (15s.)—JOHN WHARTON, Hawes. (Buff laced.)  
2317 III. (10s.)—J. G. MORTEN, Derby Fields, Spondon, Derby. (White.)  
2313 B. N. & H. C.—JAS. & C. E. BATEMAN, Sedbergh, R.S.O. (Buff.)

## Orpingtons.

**Class 290.—Orpington Cocks.** [12 entries, 1 absent.]

- 2328 I. (30s.)—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
2329 II. (15s.)—R. DE C. PEELE, The Church House, near Ludlow. 1899.  
2323 III. (10s.)—THOMAS BARRETT, Crossvale, Llanpumpsaint, Carmarthen.  
2326 B. N. & H. C.—DR. F. RUTHERFOORD HARRIS, Llangibby Castle, Usk.  
H. C.—ABBOT BROS., for No. 2321; R. R. WHITFIELD, for No. 2331.  
Com.—J. R. P. LEGH, for No. 2327; FRANCIS O. TAYLOR, for No. 2330.

**Class 291.—Orpington Hens.** [9 entries, none absent.]

- 2336 I. (30s.)—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
2337 II. (15s.)—R. DE C. PEELE, The Church House, near Ludlow, Salop. 1899.  
2333 III. (10s.)—THOMAS BARRETT, Crossvale, Llanpumpsaint, Carmarthen.  
2340 B. N. & H. C.—R. R. WHITFIELD, Rodidge Farm, Fradley, Lichfield.  
H. C.—W. COOK & SONS, for No. 2335; FRANCIS O. TAYLOR, for No. 2333.  
2334 Com.—W. L. COLE.

**Class 292.—Orpington Cockerels.** [8 entries, 2 absent.]

- 2345 I. (30s.)—HALLAM & LITTING, Prospect House, Erdington, Birmingham.  
2344 II. (15s.)—WILLIAM COOK & SONS, Orpington House, St. Mary Cray.  
2346 III. (10s.)—FRANK NEAVE, Lingwood, Norwich. Jan.  
2347 B. N. & H. C.—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
2348 H. C.—R. DE C. PEELE.

**Class 293.—Orpington Pullets.** [18 entries, 1 absent.]

- 2360 I. (30s.)—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
2365 II. (15s.)—R. R. WHITFIELD, Rodidge Farm, Fradley, Lichfield. Feb.  
2361 III. (10s.)—R. DE C. PEELE, The Church House, near Ludlow. Jan. 2.  
2363 B. N. & H. C.—WM. SLATER, Bigland House, Silverdale, Lancs. Jan. 2.  
H. C.—W. L. COLE, for No. 2351; WM. COOK & SONS, for No. 2353;  
ALEX. M. WILSON, for No. 2367.  
Com.—J. R. P. LEGH, for No. 2358; COLONEL S. SANDBACH, for No. 2362; REV. T. W. STURGES, for No. 2364.

## Houdans.

**Class 294.—Houdan Cocks.** [3 entries.]

- 2368 I. (30s.)—MESDAMES HILL & MACONCHIE, Tovil, Maidstone.  
2369 II. (15s.)—PHILIP LEE, Wem, Salop. 1898.  
2370 III. (10s.)—S. W. THOMAS, Glasfryn, Forest Fach, Swansea,

**Class 295.—Houdan Hens.** [7 entries, none absent.]

- 2374 I. (30s.), & 2373 B. N. & H. C.—MESDAMES HILL & MACONCHIE, Tovil, Maidstone. Over 1 year.  
 2377 II. (15s.), & 2376 H. C.—S. W. THOMAS, Glasfryn, Forest Fach, Swansea.  
 2372 III. (10s.)—JONATHAN HILL, Bridgend Mills, Lostwithiel, Cornwall. 1897.

**Class 296.—Houdan Cockerels.** [3 entries, 1 absent.]

- 2378 II. (15s.)—MESDAMES HILL & MACONCHIE, Tovil, Maidstone. Feb.  
 2380 III. (10s.)—S. W. THOMAS, Glasfryn, Forest Fach, Swansea. Feb. 9.

**Class 297.—Houdan Pullets.** [3 entries, 1 absent.]

- 2381 I. (30s.), & 2382 III. (10s.)—JONATHAN HILL, Bridgend Mills, Lostwithiel, Cornwall. Jan. 21.

**French (Any Variety, Houdans excepted).**

**Class 298.—French Cocks or Cockerels.** [6 entries, none absent.]

- 2387 I. (30s.), & 2388 B. N. & H. C.—PHILIP LEE, Wem, Salop. (Crève Cœur.) 1898.  
 2389 II. (15s.)—S. W. THOMAS, Glasfryn, Forest Fach, Swansea. (Crève.)  
 2384 III. (10s.)—FRANK ALCOCK, Hill Farm, Forthampton, Tewkesbury. (Salmon Faverolle.) 1898.  
 2386 H. C.—FRANK ALCOCK.

**Class 299.—French Hens or Pullets.** [7 entries, none absent.]

- 2395 I. (30s.)—PHILIP LEE, Wem. (La Flèche). 1898.  
 2390 II. (15s.)—FRANK ALCOCK, Hill Farm, Forthampton, Tewkesbury. (Salmon Faverolle.) 1898.  
 2396 III. (10s.)—S. W. THOMAS, Glasfryn, Forest Fach, Swansea. (Crève.)  
 2394 B. N. & H. C.—PHILIP LEE, Wem, Salop. (Crève Cœur.) 1898.  
 2391 H. C.—FRANK ALCOCK.

**Minorcas.**

**Class 300.—Minorca Cocks.** [9 entries, 1 absent.]

- 2397 I. (30s.)—J. W. CROSSMAN, The Shrubberies, Galphay, Ripon. 1898.  
 2404 II. (15s.), & 2403 B. N. & H. C.—A. G. PITTS, The Firs, Highbridge.  
 2399 III. (10s.)—THOMAS F. HORSLEY, South Grove, Highgate. Apr., 1899.  
 H. C.—J. GILLIES, for No. 2398; J. H. KNOWLES-MORGAN, for No. 2401.  
 2402 Com.—SAMSON PARKER.

**Class 301.—Minorca Hens.** [13 entries, none absent.]

- 2413 I. (30s.), & 2414 III. (10s.)—A. G. PITTS, The Firs, Highbridge.  
 2411 II. (15s.)—J. H. KNOWLES-MORGAN, Carter's Green, West Bromwich.  
 2412 B. N. & H. C.—S. PARKER, 261 Green Lane, Birchills, Walsall. 1898.  
 H. C.—JOHN GILLIES, for No. 2408; JOHN E. HEATON, for No. 2409;  
 G. T. KENWORTHY, for No. 2410; T. C. PLOWMAN, for No. 2415;  
 COLONEL S. SANDBACH, for No. 2416.

**Class 302.—Minorca Cockerels.** [4 entries.]

- 2422 I. (30s.)—MARSHALL & BAYLEY, Mere Side Farm, Mere, Knutsford. Jan.  
 2419 II. (15s.)—FREDERICK ADAMS, 19 Bank Street, Walsall. Jan. 20.  
 H. C.—J. W. CROSSMAN, for No. 2420; TENNYSON FAWKES, for No. 2421.

**Class 303.—Minorca Pullets.** [2 entries.]

- 2424 I. (30s.)—TENNYSON FAWKES, Stroud, Glos. Jan. 15.  
 2423 II. (15s.)—J. W. CROSSMAN, The Shrubberies, Galphay, Ripon. Jan.

## Leghorns.

### Class 304.—*White Leghorn Cocks.* [5 entries, 1 absent.]

- 2428 I. (30s.)—WADE BROS., Silsden, near Keighley.  
 2426 II. (15s.)—RICHARD CONING, Crockey Hill, York. May 7, 1899.  
 2429 III. (10s.)—BERKELEY D. WISE, Greenisland, Belfast. Feb. 1899.  
 2427 B. N. & H. C.—J. READER, Leghorn House, Escrick, York. Mar., 1899.

### Class 305.—*White Leghorn Hens.* [3 entries.]

- 2430 I. (30s.)—WILLIAM GILL, 13 Strawberry Cottages, Silsden, Yorks. 1899.  
 2432 II. (15s.)—WADE BROS., Silsden, near Keighley.  
 2431 III. (10s.)—J. READER, Leghorn House, Escrick, York. May 5, 1899.

### Class 306.—*Leghorn Cocks, any other colour.*

[7 entries, none absent.]

- 2435 I. (30s.)—JOHN HURST, South Terrace, Glossop, Derbyshire. Apr., 1899.  
 2436 II. (15s.)—ROBERT H. LINGWOOD, Needham Market. 1899.  
 2439 III. (10s.)—A. WIDD, Newton Common, Earlestown, Lancs. Apr. 1899.  
 2433 B. N. & H. C.—JAS. & C. E. BATEMAN, Firbank, Sedbergh, R.S.O. 1899.  
 Com.—G. H. MARCHANT, for No. 2437; HON. MARY HAWKE, for No. 2434.

### Class 307.—*Leghorn Hens, any other colour.* [4 entries.]

- 2442 I. (30s.)—JOHN HURST, South Terrace, Glossop, Derbyshire. Apr., 1899.  
 2443 II. (15s.)—G. H. MARCHANT, Upper Fant Road, Maidstone. 1899.  
 2441 III. (10s.)—THOMAS HADFIELD, Dove Holes, nr. Buxton. April 15, 1899.  
 2440 Com.—W. J. DE SALIS.

### Class 308.—*Leghorn Cockerels, any colour.* [5 entries.]

- 2448 I. (30s.)—WADE BROS., Silsden, near Keighley. Jan. 14.  
 2446 II. (15s.)—FREDERICK MILLER, St. Augustine's, Penarth, Glam. Jan. 1.  
 2445 III. (10s.)—J. R. P. LEGH, Hallside, Knutsford. Feb.  
 Com.—RICHARD CONING, for No. 2444; DR. MOSSOP, for No. 2447.

### Class 309.—*Leghorn Pullets, any colour.* [9 entries, none absent.]

- 2450 I. (30s.)—RICHARD CONING, Crockey Hill, York. Jan. 17.  
 2455 II. (15s.)—J. READER, Leghorn House, Escrick, York. Feb. 6.  
 2449 III. (10s.)—ROBERT CHIPPINDALE, Hampson Green, Ellel, nr. Lancaster.  
 2456 B. N. & H. C.—WM. SLATER, Bigland House, Silverdale, Lancs. Jan. 2.  
 H. C.—RICHARD CONING, for No. 2451; FREDERICK MILLER, for No. 2453; DR. MOSSOP, for No. 2454.  
 2457 Com.—WADE BROS.

## Andalusians.

### Class 310.—*Andalusian Cocks or Cockerels.*

[6 entries, none absent.]

- 2460 I. (30s.)—W. H. BOURNE, Golden Grove, Chester. April 15, 1899.  
 2462 II. (15s.)—FREDERICK PORTER, High Street, Bridgwater. April, 1899.  
 2459 III. (10s.)—H. W. BIDDLECOMBE, 27 High St., Bridgwater, April, 1899.  
 2463 B. N. & H. C.—FREDERICK PORTER, Bridgwater. March, 1899.

### Class 311.—*Andalusian Hens or Pullets.* [7 entries, 1 absent.]

- 2466 I. (30s.)—W. H. BOURNE, Golden Grove, Chester. May 6, 1899.  
 2470 II. (15s.)—FREDERICK PORTER, High Street, Bridgwater. April, 1899.  
 2464 III. (10s.)—ABBOT BROS., Thuxton, Norfolk.  
 2469 B. N. & H. C.—FREDERICK PORTER, Bridgwater. March, 1899.  
 2465 H. C.—H. W. BIDDLECOMBE.

## Hamburghs.

### Class 312.—*Hamburgh Cocks or Cockerels, any variety.*

[5 entries.]

- 2473 I. (30s.), & 2474 II. (15s.).—H. PICKLES, Kayfield House, Earby, Colne.  
 2475 III. (10s.).—WM. SNELL, 129 High Street, Crediton. April 10, 1899.  
 2472 B. N. & H. C.—REV. SEYMOUR ASHWELL, Finmere Rectory, Buckingham.  
 2471 H. C.—FRED ANDERTON.

### Class 313.—*Hamburgh Hens or Pullets, any variety.*

[8 entries, none absent.]

- 2478 I. (30s.), & 2479 B. N. & H. C.—H. PICKLES, Earby, Colne.  
 2477 II. (15s.).—JOHN GILLIES, Edington Mills, Chirnside, Berwickshire. 1898.  
 2481 III. (10s.).—WM. SNELL, 129 High Street, Crediton. May 1, 1899.  
 2482 H. C.—WAKEFIELD & ELLIOTT.

## Any Other Recognised Breeds. (*Bantams excepted.*)

### Class 314.—*Cocks.* [4 entries, 1 absent.]

- 2486 I. (30s.).—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs. (Polish.)  
 2484 II. (15s.).—FRED ANDERTON, Sawley Grange, Skipton, Yorks. (Spanish.)  
 2485 III. (10s.).—VISCOUNT DEERHURST, Birlingham House, Pershore. (Silkie.) 1899.

### Class 315.—*Hens.* [6 entries.]

- 2492 I. (30s.).—JOSEPH PARTINGTON, The Woodlands, Lytham (Polish.)  
 2488 II. (15s.).—FRED ANDERTON, Sawley Grange, Skipton, Yorks. (Spanish.)  
 2491 III. (10s.).—PHILIP HINDE, Jun., Sandiway, Northwich, Cheshire. (Modern Game.) April 1, 1899.  
 2493 B. N. & H. C.—H. PICKLES, Kayfield House, Earby, Colne. (Spanish.)  
 , H. C.—VISCOUNT DEERHURST, for No. 2489 (Silkie); PHILIP HINDE, Jun., for No. 2490 (Modern Game).

### Class 316.—*Cockerels.* [2 entries.]

- 2494 I. (30s.).—FRED ANDERTON, Sawley Grange, Skipton, Yorks. (Spanish.)  
 2495 II. (15s.).—WM. MELLODY, 12 Wellington Road, Turton, Bolton. (Malay.)

### Class 317.—*Pullets.* [1 entry.]

- 2496 I. (30s.).—FRED ANDERTON, Sawley Grange, Skipton, Yorks. (Spanish.)

## DUCKS.

### Aylesbury.

### Class 318.—*Aylesbury Drakes.* [7 entries, none absent.]

- 2503 I. (30s.).—FREDK. READ, Aston Clinton, near Tring. 1 year.  
 2499 II. (15s.).—JOHN GILLIES, Edington Mills, Chirnside, N.B. 1897.  
 2500 III. (10s.).—JOHN GILLIES, Chirnside. 1899.  
 2501 B. N. & H. C.—DR. F. RUTHEFOORD HARRIS, Llangibby Castle, Usk.

### Class 319.—*Aylesbury Ducks.* [8 entries, 2 absent.]

- 2506 I. (30s.).—J. GILLIES, Edington Mills, Chirnside, Berwickshire. 1896  
 2510 II. (15s.).—FREDK. READ, Aston Clinton, near Tring. 1 year.  
 2504 III. (10s.).—WM. BYGOTT, Ryehill House, Ulceby, Lincs. April, 1893.  
 2511 B. N.—MRS. J. C. STRAKER, The Leazes, Hexham.

**Class 320.—Aylesbury Young Drakes.** [4 entries.]

- 2515 I. (30s.), & 2514 II. (15s.).—F. READ, Aston Clinton, near Tring. Mar. 21.  
 2513 III. (10s.), & 2512 B. N.—JOHN GILLIES, Edington Mills, Chirnside, Berwickshire. March.

**Class 321.—Aylesbury Ducklings.** [4 entries.]

- 2519 I. (30s.), & 2518 III. (10s.).—F. READ, Aston Clinton, near Tring.  
 2516 II. (15s.), & 2517 B. N.—JOHN GILLIES, Edington Mills, Chirnside. March.

**Rouen.****Class 322.—Rouen Drakes.** [6 entries, none absent.]

- 2523 I. (30s.).—JOSEPH PARTINGTON, The Woodlands, Lytham, Lancs.  
 2522 II. (15s.).—JOHN GILLIES, Edington Mills, Chirnside, Berwickshire. 1898.  
 2521 III. (10s.).—WILLIAM BYGOTT, Ryehill House, Ulceby, Linca. 1898.  
 2524 B. N.—A. T. & H. PEARs, Mere, near Lincoln.

**Class 323.—Rouen Ducks.** [9 entries, none absent.]

- 2526 I. (30s.).—HENRY W. BELL, Caville Hall, Howden, Yorks. April, 1897.  
 2527 II. (15s.).—HENRY W. BELL, Howden. April, 1898.  
 2528 III. (10s.).—WILLIAM BYGOTT, Ryehill House, Ulceby. April, 1898.  
 2533 B. N.—MRS. J. C. STRAKER, The Leazes, Hexham.

**Pekin.****Class 324.—Pekin Drakes.** [3 entries.]

- 2535 I. (30s.).—E. F. BOSANQUET, Steeple Ashton House, Trowbridge, Wilts.  
 2537 II. (15s.).—PERCY PERCIVAL, Somerset Court, Brent Knoll, Somerset.  
 2536 III. (10s.).—S. DALGLIESH, Blackburn, Chirnside, Berwickshire.

**Class 325.—Pekin Ducks.** [3 entries.]

- 2539 I. (30s.).—S. DALGLIESH, Blackburn, Chirnside, Berwickshire. 1899.  
 2540 II. (15s.).—PERCY PERCIVAL, Somerset Court, Brent Knoll, Somerset.  
 2538 B. N.—E. F. BOSANQUET, Steeple Ashton House, Trowbridge, Wilts.

**Cayuga.****Class 326.—Cayuga Drakes.** [5 entries, none absent.]

- 2542 I. (30s.).—R. S. WILLIAMSON, Cannock Wood House, Hednesford.  
 2543 II. (15s.).—R. S. WILLIAMSON, Hednesford.  
 2545 III. (10s.), & 2544 B. N.—LADY WILSON, Chillingham Barns, Belford. 1898.

**Class 327.—Cayuga Ducks.** [2 entries.]

- 2546 II. (15s.).—R. S. WILLIAMSON, Cannock Wood House, Hednesford. 1899.  
 2547 III. (10s.).—LADY WILSON, Chillingham Barns, Belford. 1898.

**Any Breeds.** (*Aylesburys excepted.*)**Class 328.—Young Drakes.** [3 entries.]

- 2549 II. (15s.).—WILLIAM BYGOTT, Ryehill House, Ulceby, Linca. (Rouen.)  
 2548 III. (10s.).—HON. SYBIL AMHERST, Didlington Hall, Brandon. (Pekin.)  
 2550 B. N.—VISCOUNT DEERHURST, Birlingham Ho., Pershore. (Cayuga.)

**Class 329.—Ducklings.** [3 entries.]

- 2553 I. (30s.), & 2552 II. (15s.).—WILLIAM BYGOTT, Ryehill House, Ulceby, Linca. (Rouen.) March 16.  
 2551 III. (10s.).—HON. SYBIL AMHERST, Didlington Hall, Brandon. (Pekin.)

## Geese.

### Class 330.—*Emden Ganders.* [6 entries, none absent.]

- 2554 I. (£2.) & 2555 II. (£1.)—ABBOT BROS., Thuxton, Norfolk. 1898.  
 2558 III. (10s.)—W. D. WEDGEWOOD, Highfield, Hutton Sessay, Thirsk. 3 yrs.  
 2557 B. N. & H. C.—HON. SYBIL AMHERST, Didlington Hall, Brandon.

### Class 331.—*Emden Geese.* [6 entries, none absent.]

- 2565 I. (£2.)—W. D. WEDGEWOOD, Highfield, Hutton Sessay, Thirsk. 4 yrs.  
 2561 II. (£1.) & 2562 III. (10s.)—ABBOT BROS., Thuxton, Norfolk. 1898.  
 2564 B. N. & H. C.—F. G. S. RAWSON, Thorpe, Halifax.  
 2560 H. C.—ABBOT BROS.

### Class 332.—*Toulouse Ganders.* [4 entries.]

- 2566 I. (£2.)—WILLIAM BYGOTT, Ryehill House, Ulceby, Lincs. May, 1898.  
 2568 II. (£1.)—F. G. S. RAWSON, Thorpe, Halifax.  
 2569 III. (10s.)—T. D. STAGG, Osbaldwick Hall, York. May, 1899.  
 2567 B. N.—J. A. COULSON, Watton Abbey, Beverley, Yorks. 1898.

### Class 333.—*Toulouse Geese.* [6 entries, none absent.]

- 2570 I. (£2.)—WILLIAM BYGOTT, Ryehill House, Ulceby, Lincs. May 1898.  
 2575 II. (£1.)—W. WOODS, Edwinstowe, Newark. 2 years.  
 2573 III. (10s.)—T. D. STAGG, Osbaldwick Hall, York. May, 1899.  
 2571 B. N.—J. A. COULSON, Watton Abbey, Beverley, Yorks. 1898.

## Turkeys.

### Class 334.—*Turkey Cocks.* [10 entries, 2 absent.]

- 2577 I. (£2.)—ABBOT BROS., Thuxton, Norfolk. (Mammoth Bronze.) 1899  
 2585 II. (£1.)—W. WOODS, Edwinstowe, Newark. (American Bronze.) 3 yrs.  
 2580 III. (10s.)—MRS. F. C. SMITH, Oaklands, Boyle, co. Roscommon.  
 (Bronze.) May 18, 1898.  
 2579 B. N. & H. C.—W. & D. HELM, Wilton, near Redcar, Yorks. 2 years.  
 2584 H. C.—LADY WILSON.  
 Com.—ABBOT BROS., for No. 2576; MISS LUCY BETHELL, for No. 2578;  
 THOMAS D. STAGG, for No. 2582.

### Class 335.—*Turkey Hens.* [10 entries, none absent.]

- 2586 I. (£2.) & 2587 II. (£1.) & 2588 III. (10s.)—ABBOT BROS., Thuxton, Norfolk. (Mammoth Bronze.) 1899.  
 2594 B. N. & H. C.—LADY WILSON, Chillingham Barns, Belford. (Bronze.)  
 2592 H. C.—THOMAS D. STAGG. 2590 Com.—THOMAS ROGERS.

## Table Poultry.

### Class 336.—*Pairs of Cockerels, of any pure breeds.*

[7 entries, 1 absent.]

- 2598 I. (30s.)—R. W. CRESWELL-WARD, Neasham Hill, Darlington. (Buff Wyandotte.) Jan. 11.  
 2602 II. (15s.)—LADY WILSON, Chillingham Barns, Belford. (Plymouth Rocks.) Feb. 16.  
 2596 III. (10s.)—FRANK ALCOCK, Hill Farm, Forthampton, Tewkesbury (Salmon Faverolle.) Jan.  
 2599 B. N.—MISS BEATRICE C. LEIGH, Stonehouse, Glos. (Faverolle).

### Class 337.—*Pairs of Pullets, of any pure breeds.*

[3 entries.]

- 2603 I. (30s.)—WILLIAM BIBBY, Markland Hill, Bolton-le-Moors, Lancs (Golden Wyandottes.) Jan 1.

2604 II. (15s.)—ALEX. M. WILSON, East Keal Manor, Spilsby, Lincs. (Buff Orpington.) Feb. 6.

2605 B. W.—LADY WILSON, Chillingham Barns, Belford. (Plymouth Rock.)

**Class 338.**—*Pairs of Cockerels, of a first cross (Indian Game-Dorking or Dorking-Indian Game).* [3 entries.]

2607 II. (15s.), & 2608 B. W.—ABBOT BROS., Thuxton, Norfolk. Jan.

2608 III. (10s.)—LADY WILSON, Chillingham Barns, Belford. Feb. 16.

**Class 339.**—*Pairs of Pullets, of a first cross (Indian Game-Dorking or Dorking-Indian Game).* [5 entries, none absent.]

2611 I. (30s.)—LADY WILSON, Chillingham Barns, Belford. Jan. 4.

2613 II. (15s.), & 2612 B. W.—LADY WILSON, Chillingham Barns. Feb. 16.

2610 III. (10s.)—ABBOT BROS., Thuxton, Norfolk. Jan.

**Class 340.**—*Pairs of Cockerels, of a first cross (Indian Game-Dorking and Dorking-Indian Game excepted) from any pure breeds.* [1 entry.]

2614 II. (15s.)—A. T. & H. PEARS, Mere, near Lincoln. (Indian Game and Buff Orpington.) Feb.

**Class 341.**—*Pairs of Pullets, of a first cross (Indian Game-Dorking and Dorking-Indian Game excepted) from any pure breeds.* [2 entries, 1 absent.]

2615 II. (15s.)—A. T. & H. PEARS, Mere, near Lincoln. (Indian Game and Buff Orpington.) Feb.

**Class 342.**—*Pairs of Cockerels, of any cross (other than those mentioned in Classes 338 to 341).* [2 entries.]

2618 I. (30s.)—JOHN R. WADMAN, Bodle Street, Hailsham, Sussex. (Indian Game and Sussex.) Feb. 20.

2617 B. W.—MRS. J. C. STRAKER, The Leazes, Hexham. (Wyandotte and Redcap.)

**Class 343.**—*Pairs of Pullets, of any cross (other than those mentioned in Classes 338 to 341).* [1 entry.]

2619 I. (30s.)—MRS. J. C. STRAKER, The Leazes, Hexham. (Wyandotte and Redcap.) Feb.

## Table Ducklings.

**Class 344.**—*Pairs of Ducklings, of any pure breed.*  
[5 entries, none absent.]

2621 I. (30s.), & 2620 III. (10s.)—FREDERICK READ, Aston Clinton, Tring. (Aylesbury.) April 25.

2622 II. (15s.)—MRS. STANYFORTH, Kirk Hammerton Hall, York. (Aylesbury.) April 12.

2623 B. W.—JOHN R. WADHAM, Bodle Street, Hailsham. (Aylesbury.) Mar. 9.

**Class 345.**—*Pairs of Ducklings, of a first cross from any pure breeds.* [2 entries, 1 absent.]

2626 III. (10s.)—W. D. WEDGEWOOD, Highfield, Hutton Sessay, Thirsk.

# FARM AND DAIRY PRODUCE OF THE UNITED KINGDOM.

## Butter.

**Class 346.**—*Kegs or other Packages of Butter, not less than 14 lb. and under 40 lb. in weight, delivered on or before Saturday, May 5th, 1900.* [15 entries, none absent.]

- 2634 I. (£5.)—C. HAYES, Keyford House Farm, Frome, Somerset. (Cross-bred Cows : Cream raised in shallow pans, churned at 54°, dry salted. Made May 4.)
- 2640 II. (£3.)—ARTHUR F. SOMERVILLE, Home Dairy Farm, Dinder, Wells, Somerset. (Jersey Cows : Separated cream, churned at 54°, dry salted. Made May 3.)
- 2639 R. N. & H. C.—MISS MABEL G. PRIDEAUX, Motcombe, Shaftesbury, Dorset. (Shorthorn and Hereford cows : Separated cream, churned at 56°, brined and dry-salted on butter worker. Made May 3.)
- H. C.—THE KILLESHANDRA CO-OPERATIVE AGRICULTURAL & DAIRY SOCIETY, LTD., for No. 2635 ; WILLIAM G. M. TOWNLEY, for No. 2641.
- 2632 Com.—THE GLENWILLIAM CO-OPERATIVE DAIRY SOCIETY, LTD.

**Class 347.**—*Boxes of twelve two-pound rolls of Butter, made with not more than 1 per cent. of salt.* [23 entries, 6 absent.]

- 2652 I. (£5.)—THE GLENWILLIAM CO-OPERATIVE DAIRY SOCIETY, LTD., Ballingarry, co. Limerick.
- 2645 II. (£3.)—THE COAGH CO-OPERATIVE DAIRY SOCIETY, LTD., Coagh, co. Tyrone.
- 2644 III. (£1.)—THE BELLEEK CO-OPERATIVE AGRICULTURAL & DAIRY SOCIETY, LTD., Belleek, co. Fermanagh.
- 2659 R. N. & H. C.—MRS. W. E. MUDD, Slade House, Thornthwaite, nr. Ripley.
- 2646 H. C.—THE CO. MONAGHAN CENTRAL CO-OPERATIVE AGRICULTURAL AND DAIRY SOCIETY, LTD.
- 2660 Com.—THE NIDDERDALE DAIRY CO., LTD.

**Class 348.**—*Two pounds Fresh Butter, slightly Salted, made up in pounds.* [68 entries, 5 absent.]

- 2709 (£3.)—MRS. J. H. PHILLIPS, Winsford Dairy, Bideford, Devon.
- 2710 (£3.)—LORD POLTIMORE, Poltimore Park, Exeter.
- 2722 (£3.)—O. A. SMITH-RYLAND, Barford Hill, Warwick.
- 2723 (£3.)—A. F. SOMERVILLE, Home Dairy Farm, Dinder Wells, Som.
- 2685 (£2.)—ANTONY GIBBS, Tyntesfield, Bristol.
- 2687 (£2.)—THOMAS S. GOOCH, Bovingdon, Hemel Hempstead.
- 2691 (£2.)—LORD HASTINGS, Melton Constable, Norfolk.
- 2715 (£2.)—LORD ROTHSCHILD, Tring Park, Tring, Herts.
- 2668 (£1.)—JOHN BAINES, West End Farm, Henfield, Sussex.
- 2677 (£1.)—LADY DE ROTHSCHILD, Aston Clinton, Tring, Herts.
- 2692 (£1.)—CHARLES HAYES, Keyford House Farm, Frome, Somerset.
- 2714 (£1.)—THE EARL OF ROSEBURY, K.G., Mentmore, Leighton Buzzard.
- 2729 R. N. & H. C.—MISS URWIN, Dunskins, Wolsingham, R.S.O., co. Durham.
- H. C.—MISS DAWSON, for No. 2676 ; THE HON. A. HOLLAND-HIBBERT, for No. 2693 ; CHARLES E. KEYSER, for No. 2696 ; MRS. SMITH-NEILL, for No. 2721 ; WILLIAM G. M. TOWNLEY, for No. 2727.
- Com.—VISCOUNT DOWNE, for No. 2679 ; MISS E. G. GERRARD, for No. 2684 ; THE HON. E. W. B. PORTMAN, for No. 2711 ; GEORGE MURRAY SMITH, for No. 2720 ; COLONEL A. F. WALTER, for No. 2730.

**Class 349.**—*Two pounds Fresh Butter, slightly salted, made up in pounds, from Milk drawn from Cows other than Channel Islands, or Cows crossed with Channel Islands Breeds.*

[62 entries, 3 absent.]

- 2750 (£3.)—ANTONY GIBBS, Tyntesfield, Bristol.  
 2779 (£3.)—LORD POLTIMORE, Poltimore Park, Exeter.  
 2756 (£2.)—CHARLES HAYES, Keyford House Farm, Frome, Somerset.  
 2775 (£2.)—MRS. MARY PARRY, Hafod-y-Rhug, Llanrug, R.S.O., Carnarvon.  
 2781 (£2.)—THE EARL OF ROSEBURY, K.G., Mentmore, Leighton Buzzard.  
 2787 (£2.)—MISS URWIN, Dunskins, Wolsingham, co. Durham.  
 2742 (£1.)—VISCOUNT DOWNE, Baldersby Park, Thirsk.  
 2755 (£1.)—LORD HASTINGS, Melton Constable, Norfolk.  
 2763 (£1.)—MRS. J. JONES, Bale Green Farm, Mickleton, Yorks.  
 2789 (£1.)—COL. A. F. WALTER, Bear Wood, Wokingham, Berks.  
 2745 R. N. & H. C.—MISS LOUISA DUCKITT, Braithwaite, Doncaster.  
 H. C.—MRS. SARAH GREAVES, for No. 2753; THE HON. A. HOLLAND-HIBBERT, for No. 2757; MISS E. A. HUMPHREYS, for No. 2759; THE MONEYMORE CO-OPERATIVE DAIRY SOCIETY, for No. 2771; C. A. SMITH-RYLAND, for No. 2785.  
 Com.—MRS. M. E. BROWN, for No. 2736; MISS DORA H. PATTISON, for No. 2776.

## Cheese.

**Class 350.**—*Three Cheddar Cheeses, of not less than 50 lb. each, made in 1900.* [11 entries, none absent.]

- 2804 I. (£8.)—W. C. SPENCER, Halstock, Yeovil, Somerset.  
 2797 II. (£5.)—THEODORE C. CANDY, Woolcombe Farm, Cattistock, Dorset.  
 2795 III. (£3.)—JOHN ASHBY, Spiers Piece, Steeple Ashton, Trowbridge.  
 2805 IV. (£1.)—H. E. TUCKER, Church Farm, Steeple Ashton, Trowbridge.  
 2800 R. N. & H. C.—EDMUND W. GREEN, Steeple Ashton, Trowbridge, Wilts.

**Class 351.**—*Three Cheshire Cheeses, of not less than 40 lb. each, made in 1900.* [13 entries, 3 absent.]

- 2815 I. (£8.)—RICHARD MULLOCK, Guy Lane Farm, Waverton, Chester.  
 2817 II. (£5.)—MRS. WALLEY, Frankton, Oswestry, Salop.  
 2818 III. (£3.)—RICHARD P. WALLEY, Cotton Abbots, Waverton, Chester.  
 2807 IV. (£1.)—T. BATHO, New Martin, Chirk, Salop.  
 2806 R. N. & Com.—MISS E. BATHO, Winston, Ellesmere, Salop.

**Class 352.**—*Three Stilton Cheeses, made in 1900.* [8 entries, none absent.]

- 2821 I. (£5.)—MRS. CHARLOTTE FAIRBROTHER, Beeby, Leicester.  
 2823 II. (£3.)—ANDREW WILLIAM HURST, Manor House, Beeby, Leicester.  
 2820 III. (£2.)—HERBERT ARCHIBALD DYSON, Beeby, Leicester.  
 2825 R. N. & H. C.—JOHN SMITH, Gaddesby, near Leicester.  
 2826 Com.—W. S. WALPOLE.

**Class 353.**—*Three Wensleydale or Cotherstone Cheeses (Stilton Shape), made in 1900.*<sup>1</sup> [8 entries, none absent.]

- 2832 I. (£10.)—METCALFE SPENSLEY, Castle Bank, Leyburn, R.S.O., Yorks.  
 2830 II. (£5.)—MISS A. MARION REYNOLDS, Elwick Hall, Castle Eden.  
 2833 III. (£3.)—JOHN STUBBS, Swinithwaite, West Witton, Leyburn, R.S.O.  
 2834 R. N. & H. C.—MRS. MARIA WILLIS, Manor House, Carperby, Ayasgarth.  
 2831 Com.—ALFRED ROWNTREE.

<sup>1</sup> Prizes given by the York Local Committee.

**Class 354.—Three Wensleydale or Cotherstone Cheeses (Flat Shape), made in 1900.<sup>1</sup>** [6 entries, none absent.]

- 2837 II. (£5.).—RICHARD EWBANK, The Temple, Leyburn, R.S.O., Yorks.  
 2839 III. (£3.).—METCALFE SPENSLEY, Castle Bank, Leyburn, R.S.O., Yorks.  
 2836 R. N. & Com.—WILLIAM BUSHBY, Swinithwaite, Leyburn, R.S.O., Yorks.

**Class 355.—Three Cleveland Cheeses (Stilton Shape), made in 1900.<sup>1</sup>** [9 entries, 1 absent.]

- 2841 I. (£5.).—JOSEPH DALE, Stormy Hall, Danby, Grosmont, R.S.O., Yorks.  
 2849 II. (£3.).—RICHARD TYREMAN, Lealholm, Grosmont, R.S.O., Yorks.  
 2846 III. (£2.).—GEORGE RAW, Ajalon House, Fryup, Grosmont, R.S.O., Yorks.  
 2843 R. N. & H. C.—WILLIAM HART, Holly Lodge, Danby, Yorks.  
 Com.—MARTIN DALE, for No. 2842; SCARTH MOON, for No. 2845.

**Class 356.—Three Cleveland Cheeses (Flat Shape), made in 1900.<sup>1</sup>** [7 entries, 2 absent.]

- 2850 I. (£5.).—JOSEPH DALE, Stormy Hall, Danby, Grosmont, R.S.O., Yorks.  
 2856 II. (£3.).—RICHARD TYREMAN, Lealholm, Grosmont, R.S.O., Yorks.  
 2853 R. N. & H. C.—SCARTH MOON, Glaisdale, Grosmont, R.S.O., Yorks.  
 2852 Com.—WILLIAM LISTER.

**Class 357.—Three Ryedale Cheeses, made in 1900.<sup>1</sup>** [4 entries, none absent.]

- 2857 I. (£5.).—MISS MARY L. DALE, Stormy Hall, Danby, Grosmont, R.S.O.  
 2858 II. (£3.).—MISS MARY J. FARROW, Park Ho., Danby, Grosmont, R.S.O.  
 2860 R. N. & Com.—MRS. G. J. SIGSWORTH, Stilton House, Helmsley, Yorks.

**Class 358.—Three Double Gloucester Cheeses, made in 1900.** [3 entries.]

- 2862 I. (£5.).—N. J. SIMS, Pitcombe, Bruton, Somerset.  
 2861 II. (£3.).—E. T. L. AUSTEN, Wolford Fields, Shipston-on-Stour.  
 2863 R. N.—MRS. W. T. S. TILLEY, East Compton, Shepton Mallet.

**Class 359.—Three Wiltshire Cheeses (Loaf or Flat), not exceeding 16 lb. each, made in 1900.** [3 entries.]

- 2865 I. (£5.).—N. J. SIMS, Pitcombe, Bruton, Somerset.  
 2864 II. (£3.).—E. T. L. AUSTEN, Wolford Fields, Shipston-on-Stour.  
 2866 R. N.—MRS. W. T. S. TILLEY, East Compton, Shepton Mallet.

**Class 360.—Three Cheeses, of any other British make (Coloured), made in 1900.** [3 entries, none absent.]

- 2869 I. (£5.).—MRS. W. T. S. TILLEY, Shepton Mallet. (Single Gloucester.)  
 2867 II. (£3.).—THE CROXDEN DAIRY ASSOCIATION, Croxden, Uttoxeter, Staffs. (Leicester.)

**Class 361.—Three Cheeses, of any other British make (Uncoloured), made in 1900.** [9 entries, 1 absent.]

- 2874 I. (£5.).—N. J. SIMS, Pitcombe, Bruton, Somerset. (Single Gloucester.)  
 2871 II. (£3.).—E. W. GREEN, Steeple Ashton, Trowbridge. (Somerset Loaf.)  
 2876 III. (£2.).—MRS. W. T. S. TILLEY, Shepton Mallet. (Caerphilly.)  
 2872 R. N. & Com.—J. MOSELEY, LTD., Anlaby Road, Hull. (Cheddar.)

<sup>1</sup> Prizes given by the York Local Committee.

## CIDER AND PERRY.

**Class 362.**—*Casks of Cider, not less than 18, and not more than 30, gallons, made in the Autumn of 1899.* [25 entries, none absent.]

- 2903 I. (£5.)—YEOMANS BROS., Canon Pyon, Hereford. (Red Styres and White Norman.)  
 2887 II. (£3.)—HERBERT J. DAVIS, Hurlingpot Farm, Shepton Mallet, Somerset. (Red Jersey, Chisel Jersey, a few White Jersey, Horner, Kingston Black, and Cap of Liberty.)  
 2891 III. (£2.)—WILLIAM PARRY, Palmers Court, Holmer, Hereford. (Kingston Black).  
 2897 E. N. & H. C.—TILLEY BROS., East Compton, Shepton Mallet, Somerset. (Gins, Royal Jerseys and Horners.)  
 H. C.—JOHN BOSLEY, for Nos. 2883 & 2884.  
 2879 Com.—W. T. ALLEN.

**Class 363.**—*One Dozen Bottles of Cider, made in the Autumn of 1899.* [42 entries, 1 absent.]

- 2907 I. (£5.)—JOHN BAZLEY, The Bury, Stoke Prior, Leominster. (Fox Whelp and White Norman.)  
 2929 II. (£3.)—HENRY THOMSON, Southends, Newent, Glos. (Cowarne Red and Normans.)  
 2944 III. (£2.)—YEOMANS BROS., Canon Pyon, Hereford. (Fox Whelp and Strawberry Normans.)  
 2915 E. N. & H. C.—J. W. COX, Purton, Berkeley, Glos. (Mixture.)  
 H. C.—H. J. DAVIS, for No. 2916; A. E. HILL, for No. 2919.  
 2945 Com.—YEOMANS BROS.

**Class 364.**—*One Dozen Bottles of Cider, made in any year before 1899.* [17 entries, 1 absent.]

- 2956 I. (£5.)—JAMES SLATTER & Co., Paxford, Campden, S.O., Worcester-shire. (Mixed Fruit, 1898.)  
 2954 II. (£3.)—A. E. HILL, Eggleton Court, Ledbury. (Handsome Norman and Cowarne Red, 1898.)  
 2950 III. (£2.)—J. BOSLEY, Lyde, Hereford. (Strawberry Norman, 1892.)

**Class 365.**—*One Dozen Bottles of Perry.* [23 entries, none absent.]

- 2976 I. (£5.)—HENRY THOMSON, Southends, Newent, Glos. (Oldfields and Moorcroft.)  
 2969 II. (£3.)—A. KNIGHT, Deep Filling Farm, Huntley, Glos. (Oldfields.)  
 2971 III. (£2.)—D. PHELPS, Tibberton, Gloucester. (Oldfields.)  
 2970 E. N. & H. C.—W. PARRY, Palmer's Court, Holmer, Hereford. (Oldfields.)  
 H. C.—H. GODWIN & SON, for No. 2967; A. KNIGHT, for No. 2968.  
 2985 Com.—YEOMANS BROS.

HIVES, HONEY, AND BEE APPLIANCES.<sup>1</sup>

## Appliances.

**Class 366.**—*Collections of Hives and Appliances.* [7 entries, none absent.]

- 2990 I. (£4.)—W. P. MEADOWS, Syston, Leicester.  
 2989 II. (£2.)—JAS. LEE & SON, 5 Holborn Place, London, W.C.  
 2988 III. (£1.)—JEMIESON & BAKER, Dringhouses, York.  
 2987 E. N. & H. C.—WM. DIXON, 5 Beckett Street, Leeds.  
 2986 H. C.—R. H. COLTMAN. 2991 Com.—W. SHEPHERD.

<sup>1</sup> Prizes given by the British Bee-keepers' Association.

**Class 367.—*Outfits for Beginners in Bee-keeping.***

[9 entries, none absent.]

- 2998 I. (20s.)—JAS. LEE & SON, 5 Holborn Place, London, W.C.  
 2999 II. (15s.)—W. P. MEADOWS, Syston, Leicester.  
 2993 III. (10s.)—R. H. COLTMAN, 49 Station Street, Burton-on-Trent.  
 2996 B. N. & H. C.—JEMIESON & BAKER, Dringhouses, York.

**Class 368.—*Observatory Hives of not less than two Frames with Bees and Queen.***

[4 entries, none absent.]

- 3004 I. (20s.)—JAS. LEE & SON, 5 Holborn Place, London, W.C.  
 3003 II. (15s.)—WM. DIXON, 5 Beckett Street, Leeds.

**Class 369.—*Frame Hives for general use, unpainted.***

[11 entries, 2 absent.]

- 3013 I. (20s.)—JAS. LEE & SON, 5 Holborn Place, London, W.C.  
 3014 II. (15s.)—W. P. MEADOWS, Syston, Leicester.  
 3015 III. (10s.)—W. P. MEADOWS, Syston.  
 3008 B. N. & H. C.—WM. DIXON, 5 Beckett Street, Leeds.  
 3010 H. C.—JEMIESON & BAKER.

**Class 370.—*Frame Hives for Cottagers' use, unpainted.***

[10 entries, 1 absent.]

- 3024 I. (20s.)—W. P. MEADOWS, Syston, Leicester.  
 3023 II. (15s.)—W. P. MEADOWS, Syston.  
 3022 III. (10s.)—JAS. LEE & SON, 5 Holborn Place, London, W.C.  
 3021 B. N. & H. C.—THOS. LANAWAY & SONS, 26 Station Road, Redhill.

**Class 371.—*Honey Extractors.*<sup>1</sup>**

[5 entries, none absent.]

- 3030 I. (15s.)—W. P. MEADOWS, Syston, Leicester.  
 3031 II. (10s.)—W. P. MEADOWS, Syston.

**Class 372.—*Useful Appliances connected with Bee-keeping, introduced since 1898.***

[6 entries, 2 absent.]

- 3033 I. ((10s.))—W. HEAD, Brilley, Whitney-on-Wye, Herefordshire.  
 3035 Certificate of Merit—JAS. LEE & SON, 5 Holborn Place, London, W.C.

**Honey.****Class 373.—*Twelve Sections of Comb Honey, gathered in 1900.***

[10 entries, 7 absent.]

- 3047 I. (15s.)—W. WOODLEY, Beedon, Newbury.  
 3040 III. (5s.)—R. BROWN, Flora Apiary, Somersham, Hunts.

**Class 374.—*Twelve Sections of Comb Honey, gathered before or in 1899.***

[3 entries, none absent.]

- 3050 I. (10s.)—W. WOODLEY, Beedon, Newbury.  
 3049 II. (7s. 6d.)—A. W. WEATHERHOGG, Willoughton, *via* Lincoln.

**Class 375.—*Twelve Sections of Comb Heather Honey, of any year.***

[9 entries, 1 absent.]

- 3059 I. (10s.)—THOMAS WALKER, Esthwaite, Hawkshead, by Ambleside.  
 3051 II (7s. 6d.)—WM. DIXON, 5 Beckett Street, Leeds.  
 3058 III. (5s.)—H. WADDINGTON, Kirby Hill, Borobridge, Yorks.  
 3053 B. N.—R. HUGGUP, Low Hedgeley, Ganton, R.S.O., Northumberland.

<sup>1</sup> Prizes in Class 371 given by Mr. T. W. Cowan.

**Class 376.**—*Three Shallow Frames of Comb Honey, for Extracting, gathered in 1900.* [6 entries, 3 absent.]

3063 I. (10s.). 3064 II. (7s. 6d.), & 3062 III. (5s.).—GEORGE WELLS, Eccles, Aylesford, Kent.

**Class 377.**—*Twelve Jars of Run or Extracted Light-coloured Honey, gathered in 1900.* [8 entries, 3 absent.]

3068 I. (15s.).—F. CHAPMAN, The Dairy, Wells, Somerset.

3073 II. (10s.).—W. WOODLEY, Beedon, Newbury.

3071 III. (5s.).—H. M. TURNER, 4 Turl Street, Oxford.

**Class 378.**—*Twelve Jars of Run or Extracted Medium-coloured Honey (other than Heather), gathered in 1900.* [7 entries, 4 absent.]

3079 I. (15s.).—E. C. R. WHITE, Holbury Mills, near Romsey.

**Class 379.**—*Twelve Jars of Run or Extracted Dark-coloured Honey (other than Heather), gathered in 1900.* [4 entries, 1 absent.]

3083 I. (15s.).—E. C. R. WHITE, Holbury Mills, near Romsey.

3082 II. (10s.).—G. W. KIRBY, Salisbury House, Longwells Green, nr. Bristol.

**Class 380.**—*Twelve Jars of Run or Extracted Honey, gathered before or in 1899.* [11 entries, 3 absent.]

3091 I. (10s.).—W. PATCHETT, Thoresway, near Caistor, Lincs.

3089 II. (7s. 6d.).—W. P. MEADOWS, Syston, Leicester.

3094 III. (5s.).—E. C. R. WHITE, Holbury Mills, near Romsey.

**Class 381.**—*Twelve Jars of Run or Extracted Heather Honey, gathered in 1899.* [12 entries, 2 absent.]

3101 I. (10s.).—T. H. JACKSON, Railway Street, Kirbymoorside, Yorks.

3105 II. (7s. 6d.).—W. SPROSTON, Shugborough, Great Haywood, Staffs.

3099 III. (5s.).—W. DRINKALL, 54 King Street, Clitheroe.

**Class 382.**—*Twelve Jars of Granulated Honey, gathered before or in 1899.* [13 entries, 2 absent.]

3114 I. (10s.).—W. P. MEADOWS, Syston, Leicester.

3118 II. (7s. 6d.).—E. C. R. WHITE, Holbury Mills, near Romsey.

3117 III. (5s.).—REV. SIDNEY SMITH, Wheldrake Rectory, York.

3109 R. N.—R. BROWN, Flora Apiary, Somersham, Hunts.

**Class 383.**—*Best and most attractive Displays of Honey in any form, and of any year.* [5 entries, 1 absent.]

3123 I. (30s.).—WM. DIXON, 5 Beckett Street, Leeds.

3124 II. (20s.).—JAS. LEE & SON, 5 Holborn Place, London, W.C.

**Miscellaneous.**

**Class 384.**—*Exhibits of not less than 3 lb. of Wax, produced by the Exhibitor's own Bees.* [13 entries, 3 absent.]

3127 I. (10s.)—JOHN BERRY, The Apiary, Llanrwst, N. Wales.

3134 II. (7s. 6d.)—REV. SIDNEY SMITH, Wheldrake Rectory, York.

3128 III. (5s.)—R. BROWN, Flora Apiary, Somersham, Hunts.

3130 R. W.—G. W. KIRBY, Salisbury House, Longwells Green, near Bristol.

**Class 385.**—*Exhibits of not less than 3 lb. of Wax, the produce of the Exhibitor's Apiary, extracted and cleaned by the Exhibitor or his Assistants.* [9 entries, 1 absent.]

3140 I. (10s.), & 3139 II. (7s. 6d.)—JOHN BERRY, Apiary, Llanrwst, N. Wales.

3141 III. (5s.)—R. BROWN, Flora Apiary, Somersham, Hunts.

3146 R. W.—REV. SIDNEY SMITH, Wheldrake Rectory, York.

**Class 386.**—*Half-gallons of Honey Vinegar.*

[3 entries, none absent.]

3150 I. (7s. 6d.)—P. SCATTERGOOD, Prospect Villa, Stapleford, Notts.

3149 II. (5s.)—G. W. KIRBY, Salisbury House, Longwells Green, near Bristol.

**Class 387.**—*Half-gallons of Mead.* [1 entry, none absent.]

[No award.]

**Class 388.**—*Interesting and instructive Exhibits of a Practical Nature connected with Bee-culture, not mentioned in the foregoing Classes.* [2 entries, none absent.]

3153 I. (10s.)—P. SCATTERGOOD, Prospect Villa, Stapleford, Notts.

**Class 389.**—*Interesting and instructive Exhibits of a Scientific Nature, not mentioned in the foregoing Classes.* [1 entry.]

3154 I. (10s.)—PERCY SHARP, Brant Broughton, Newark-on-Trent.

**IMPLEMENTS.**

**Class I.**—*General Purpose Horse-Power Cultivators.*

[18 entries.]

3237 I. (£40.)—THE HARRISON PATENTS CO., LTD., Stamford, for Cultivator, No. 5, Martin's Patent.

3322 II. (£20.)—COLEMAN & MORTON, London Road Iron Works, Chelmsford, for Cultivator, No. 8, Coleman's Patent, width of cut, 5 ft., with 7 tines.

**Class II.**—*Self-Moving Steam Diggers.* [2 entries, none absent.]

3604 I. (£40.)—THE COOPER STEAM DIGGER CO., LTD., Steel Works, King's Lynn, for Cooper Patent Steam Digger, suitable for General Agricultural and Estate work.

**Class III.—Milking Machines.** [2 entries, none absent.]

[No award on the ground of insufficient merit.]

**Class IV.—Sheep-Shearing Machines, to be driven by Power other than Hand Power.** [6 entries.]

- 4783 I. (£20).—BARTON-GILLETTE HORSE-CLIPPING AND SHEEP-SHEARING CO., LTD., 103 New Oxford Street, London, W.C., for Sheep-shearing Machine, Model C, to be worked by Mechanical Power.

**Class V.—Sheep-Shearing Machines, to be driven by Hand Power.**  
[5 entries.]

- 4785 I. (£10).—BARTON-GILLETTE HORSE-CLIPPING AND SHEEP-SHEARING CO., LTD., 103 New Oxford Street, London, W.C., for Sheep-shearing Machine, Model B, Single Standard Hand Power.

**Silver Medals.**

For Articles entered as "New Implements for Agricultural or Estate Purposes."

- 8110 HUGH REID GRIFFIN & Co., 1 Finsbury Square, London, E.C., for Flexible and Floating Elevator, single-lever Reel, detachable Divider, attached to Milwaukee Harvester and Binder.  
4113 KELSEY & Co., 41-45 Guernsey Road, Sheffield, for Improved Safety Feed Rollers. Provisional Patent Pedestal, to keep knives up to cut and allow any hard substance to pass, attached to Chaff-cutting Machine.

## HORSE-SHOEING COMPETITIONS.

*(Open to the United Kingdom.)*

**Class 1.—Hunters.** [15 entries, 1 absent.]

- 5 I. (£5).—WM. HOLT GREEN, R.S.S., Flore, Weedon, Northamptonshire.  
13 II. (£4).—ROBERT VIGAR, R.S.S., High Street, Caterham, Surrey.  
1 III. (£3).—JOHN ROBERT BAKER, R.S.S., Carnaby, Bridlington, Yorks.  
9 IV. (£2).—WILLIAM SCHOLEY, R.S.S., Worsboro' Dale, Barnsley, Yorks.  
7 V. (£1).—JOHN EDWARD MILNER, R.S.S., 24 Fammerton Street, Bradford.  
11 VI. (£1).—SAMUEL THOMPSON, R.S.S., 19 Cumberland St., Luton, Beds.  
10 B. N. & H. C.—WILLIAM STANTON, R.S.S., Castle Street, Luton, Beds.  
15 H. C.—W. WILSON, R.S.S., Rope Walk, Chapel Street, Bridlington, Yorks.

**Class 2.—Cart Horses.** [40 entries, 1 absent.]

- 40 I. (£5).—DAVID LLOYD, R.S.S., Dolygarreg Forge, Llanurda, Carmarthen.  
29 II. (£4).—ARTHUR ELLIOT, R.S.S., 32 James Street, Droylsden, Lanca.  
37 III. (£3).—JOHN IRVING, Whickham, R.S.O., co. Durham.  
23 IV. (£2).—DANIEL CRAWLEY, R.S.S., The Estate Yard, Petworth, Sussex.  
28 V. (£1).—TOM DRING, R.S.S., Redcliffe Avenue, Ashton-under-Lyne, Lanca.  
24 VI. (£1).—ELI DEA VILLE, R.S.S., Town House, Hanbury, Burton-on-Trent.  
55 B. N. & H. C.—HENRY YOUNG, Red Lion, Kelstedge, Ashover, Chesterfield.  
22 H. C.—JAMES COURTMAN, Cogenhoe, Northampton.  
44 H. C.—JOHN REES, R.S.S., 10 Chapel Bridge Terrace, Cwmcam, Mon.  
46 H. C.—THOMAS ATKIN SEARS, R.S.S., Bobbers Mill, Nottingham.  
48 H. C.—BEN. SHIPSTONE, R.S.S., 2 Robinson's Hill, Bulwell, Nottingham.  
18 Com.—GEORGE BURTON, R.S.S., 46 Liddington Street, Basford, Notts.  
20 Com.—WILLIAM CLAY, R.S.S., Alfreton, Derbyshire.  
38 Com.—ARTHUR KING, R.S.S., 24 Oxford Street, Market Rasen, Lincs.  
50 Com.—WILLIAM STEWARD, R.S.S., 60 Norfolk Street, Sheffield.

\* Recommended by the Judges for the FREEDOM OF THE WORSHIPFUL COMPANY OF FARRIERS.

# ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

## Proceedings of the Council.

WEDNESDAY, NOVEMBER 7, 1900.

EARL CAWDOR (PRESIDENT) IN THE CHAIR.

### Present:

*Trustees.*—Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., the Right Hon. Sir M. W. Ridley, Bart., M.P., Earl Spencer, K.G., Sir John H. Thorold, Bart.

*Vice-Presidents.*—Mr. H. Chandos-Pole-Gell, the Earl of Coventry, the Earl of Feversham, Lord Moreton.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. Alfred Ashworth, Viscount Baring, Mr. George Blake, Mr. J. Bowen-Jones, Lord Brougham and Vaux, Mr. Victor C. W. Cavendish, M.P., Mr. Percy Crutchley, Lieut.-Col. Curtis-Hayward, Mr. A. E. W. Darby, Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. W. Frankish, Mr. Hugh Gorringe, the Marquis of Granby, Mr. James Hornsby, Mr. John Howard Howard, Captain W. S. B. Levett, Mr. C. S. Mainwaring, Mr. Henry D. Marshall, Mr. Joseph Martin, Mr. T. H. Miller, Mr. Albert Pell, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. C. Colman Rogers, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. E. W. Stanyforth, Mr. R. Stratton, Mr. Martin J. Sutton, Mr. J. P. Terry, Mr. R. A. Warren, Mr. E. V. V. Wheeler.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, O.B., Mr. Alex. Cope, Professor McFadyean, Mr. Harold Swithinbank.

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The following members of the Cardiff Local Committee were also present:—Mr. D. T. Alexander, Mr. E. W. M. Corbett, Mr. G. C. Williams.

Apologies for non-attendance were received from Lord Arthur Cecil, Lord Middleton, Hon. Cecil T. Parker, Sir Jacob Wilson, Mr. R. C. Assheton, Mr. F. S. W. Cornwallis, Mr. R. M. Greaves, Mr. P. A. Muntz, M.P., Mr. Henry Smith, and Mr. Charles Whitehead.

The minutes of the last monthly meeting of the Council, held on August 1, 1900, having been taken as read and approved,

The PRESIDENT said that, as a matter arising out of the minutes, he might report that he had forwarded through the proper channel the Society's Address of Condolence with Her Majesty the Queen in the bereavement sustained by Her Majesty and the Royal Family by the death of His Royal Highness the Duke of Saxe-Coburg and Gotha, and that he had received in reply a letter from the Home Secretary, stating that Her Majesty had been pleased to receive the address very graciously. Unhappily, the Royal Family had very recently sustained another severe loss by the death of one of its members, and it would doubtless be the wish of the Council that he should on their behalf convey to His Royal Highness Prince Christian, who was one of their Vice-Presidents, and had always taken a deep interest in the affairs of their Society, the sincere condolences of his colleagues on the Council in the

great grief that had befallen him and the Royal Family by the sad and premature death of his son Prince Christian Victor—another gallant soldier who had lost his life in South Africa.

#### Deaths of Sir John Lawes and Mr. Samuel Rowlandson.

He had another melancholy duty to perform before entering upon the regular business of the day, viz. to report formally from the Chair the deaths during the recess of two of the most distinguished members of the Council; the one a scientist of world-wide renown, the other a fine specimen of the best type of the English farmer. Sir JOHN LAWES was a loss not only to the Society, but to the whole agricultural world. His great work at Rothamsted would live after him, and his name would go down to posterity as one of the most commanding agricultural figures of the nineteenth century. Sir John Lawes had been a member of that Council for the unprecedented period of fifty-two years. They would have been proud, if he would have accepted it, to have conferred upon Sir John the highest honour that it was in their power to bestow, by electing him President of the Society; but with the modesty which always distinguished him, he did not see his way to accept that office when offered to him, though he was always ready to give the Society the benefit of his great abilities and unequalled experience in agricultural matters. Mr. SAMUEL ROWLANDSON was known to many of those present before he joined the Council in 1889, as a man of sterling merit and high reputation as a practical farmer, and it would be difficult to find a man more energetic or more dependable. In Committees at Hanover Square, and in the administration of the show-yards, he had rendered to the Society services of extreme value; and it was with the utmost sorrow that they all learnt two winters ago that he had been stricken down by the attack from which he really never rallied, and which proved fatal last month. No men of their time and sphere showed greater thoroughness in their work or devotion to the

public interests than Sir John Lawes and Mr. Rowlandson; and the Society, as well as Agriculture at large, had lost in them two of its firmest friends and staunchest and strongest supporters. (Hear, hear.)

#### Election of New Members.

The following twenty-three candidates were elected members of the Society:—

ASHBURTON AGRICULTURAL AND PASTORAL ASSOCIATION..Canterbury, New Zealand.  
 BYASS, Sidney H...Glanogur, Bridgend.  
 CUTHBERT, J. Harold..Beaufort Castle, Hexham.  
 DALRYMPLE, Francis B...Bartley Lodge, Totton, Hants.  
 EATON, Edward M...34 Victoria Street, Westminster, S.W.  
 EDWARDS, Thomas..The Terrace House, Rhymney, Monmouth.  
 FUJINAMI, Viscount..Imperial Household, Tokio, Japan.  
 GARD, George J...7 Glynrhondia Street, Cardiff.  
 GREGG, Ralph C. E. Carr...Freshfield, Christchurch Road, Bournemouth.  
 HANKS, John..Manor Farm, Walkeringham, Gainsborough.  
 HARVEY, Sidney..Watling House, Canterbury.  
 HODGSON, Joseph..Burrell Green, Great Salkeld, Penrith.  
 MANN, James H...Canning Works, Dewsbury Road, Leeds.  
 MOON, Frank..Cavetry, Bridgend.  
 NORTH OTAGO AGRICULTURAL AND PASTORAL ASSOCIATION..Oamaru, New Zealand.  
 PASSMORE, William J...Wavensmere, Wootton Waven, near Birmingham.  
 PERKINS, Alfred L...Ormonde View, Ballycrissan, co. Galway.  
 PRICHARD, Hopkin LL..Penrice Castle Estate Office, Reynoldstone, R.S.O., Glamorgan.  
 PRICHARD, Richard K...Bryntirion, Bridgend.  
 THOMPSON, Collingwood F. J...Downham, Cornhill-on-Tweed.  
 THOMPSON, Arthur L...Villanewydd, Talgarth, Breconshire.  
 WETTON, Harold..The Abbey House, Chertsey.  
 WILLIAMSON, Samuel..Peplow, Market Drayton.

The reports of the various Standing Committees were then presented, and adopted as below:—

#### Finance.

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the three months ended October 31, as certified by the Society's accountants, showed total receipts amounting to 13,915*l.* 0*s.* 7*d.*, and expenditure to 15,470*l.* 15*s.* 2*d.* Accounts amounting in all to 1,900*l.* 19*s.* 1*d.* had been passed, and were recommended for payment. The quarterly statement of subscriptions, arrears, and property, to September 30, 1900, had been laid

upon the table. The draft statement of receipts and expenditure for the York Meeting had been submitted by the Secretary, and ordered to be laid before the Auditors for their approval.

*Financial Result of the York Meeting.*

Sir NIGEL KINGSOOTE, in presenting this Report, said that the Council would be as sorry to hear as he was to report, that the Society's Country Meeting at York last June, on which so many hopes had been built, resulted in the very considerable loss of 3,465*l.*, which would have to be met out of the Society's general funds, already most seriously depleted by the heavy deficits on the two previous shows. As the total entries of live stock were over 100 more than in 1899 (horses numbering 696 as against 424), and 2,500 more feet of space were taken in the Implement Department, it might have been expected that the gross cost of the erection and administration of a larger showyard would have involved a proportionately greater expense than in 1899, especially as timber was dearer this year. The total expenditure of the Society in connection with the York Show from first to last was only 400*l.* more than at Maidstone in 1899; but the total figure was sufficiently serious, 21,547*l.* As the exhibitors of live stock, implements, &c., who of course derived the greatest immediate benefit from the shows, only contributed in entry fees 7,827*l.* and the Local Committee 2,000*l.*, it followed that the Society was dependent for making both ends meet upon taking in the Showyard from admissions, tickets for stands, and the like, the sum of 11,720*l.* So far from doing this it only took 8,255*l.*, and therefore had to suffer a loss of 3,465*l.* The annual income from the 1*l.* subscriptions of members was the Society's only fixed source of revenue, and with the contributions from the Reserve Fund in respect of the share of the expenses due from the Life Members, had to bear all the expenditure of the many other departments of the Society's work.

It would be apparent to the Council that the enormous risk on the shows

which the Society now ran was not one which the Finance Committee could look upon with complacency. More and more demands were annually made upon the Society in connection with its shows, and more of the burden of these demands ought certainly to rest upon those who were chiefly benefited by them, viz. the exhibitors. As the Cardiff Meeting next year would be almost the last to be held under the present system, the Finance Committee did not desire, by any sudden action of their own, to imperil the success of that show; but they had never concealed their opinion that the risk for which the Society now made itself responsible in connection with the shows was too great. It would be unprofitable to discuss the probable causes of the disappointingly small attendance of the public at York, notwithstanding that there was a magnificent show of animals and implements, and that everything seemed to be in the Society's favour. It might be that agricultural shows were now overdone; that there were too many of them, and that they had ceased to attract the ordinary sight-seeing public as they once did. At all events, the Council would be wise not to base their calculations in the future upon receipts at the gates reaching the totals that they were once accustomed to, and on which he was afraid they had in the past too much relied.

*Journal.*

Sir JOHN THOROLD (Chairman) reported the publication of the third number of the current volume of the Journal, in which a memoir of the late Sir John Lawes, with a portrait, had appeared. Various accounts had been passed for payment, and the Committee recommended that the article by Mr. Druce on the Agricultural Holdings Act, 1900, should be republished as one of the Society's pamphlets at the price of 6*d.* per copy. The information contained in the pamphlet, published by the Society in 1886, on the Valuation of Unexhausted Manures, being now out of date, the Committee recommended that this pamphlet be withdrawn from circulation. The Committee had had under their consideration

the subject of the future conduct of the Journal, and were of opinion that the time had now arrived when the question of abandoning the quarterly Journal and of substituting a yearly volume, suitably bound, should be seriously considered.

Sir JOHN THOROLD observed, with reference to the recommendation as to the issue of the Society's Journal in future in one bound annual volume instead of in four quarterly numbers, that, in his opinion, the Editor had laboured under very considerable difficulties in obtaining suitable articles for the Journal in view of the competition of the weekly agricultural press, and more recently the competition of the Board of Agriculture, who published every quarter a Journal of their own similar to that of this Society. Matters of passing interest were dealt with in the weekly press; and he thought that the present time would be a good opportunity to adopt the change of publishing one volume of their Journal annually instead of issuing it in four quarterly parts. The articles contained in such an annual volume could then be of a more solid and enduring character than could be expected to appear in a quarterly journal, and by adopting the Committee's recommendation much saving in expense would also be effected.

Mr. PELL said that, as an old member of the Journal Committee, he wished to support the views advanced by Sir John Thorold, as he had for a long time been very strongly adverse to the publication of the Society's Journal in quarterly parts. With regard to the financial side of the question, there would be a very considerable saving if the Council adopted the Committee's recommendation of publishing the Journal in one annual volume. In such a volume it would, he thought, be possible to produce a little more that was worth reading and preservation. He trusted that the Council would carefully consider the matter, and at the proper time carry out the suggestion which had been made to them.

Mr. SUTTON observed that, as the member of the Journal Committee who had proposed in Committee the resolution that the Society should discontinue its system of publishing its

Journal in four quarterly parts, and in future issue it in the form of one volume annually, he should like to say that the only objection to the course recommended that presented itself to his mind was that the Society would not, perhaps, be quite so much in touch with its members in giving them a Journal only once in the year. Possibly, however, this point might to some extent be met if their Secretary could so arrange with the agricultural press that their proceedings should appear in a more extensive form than at present was the case. With regard to the financial side of the question of publishing the Journal in the form of one volume annually, there would be a very considerable saving if this plan were adopted.

Sir NIGEL KINGSCOTE said that extended reports of their proceedings were systematically issued immediately after each Council to the daily and agricultural papers, and he thought on the whole they had no reason to complain of the amount of publicity given in the press to their reports and discussions.

#### Chemical and Woburn.

Mr. STANYFORTH (Chairman) reported that a letter had been received from the Duke of Bedford's agent, stating that some land, at present let out in allotments, and adjoining the Experimental Farm at Woburn, would shortly be available for the purposes of the Society. Dr. Voelcker had been instructed to convey the thanks of the Society to Mr. Prothero for his letter, and to accept the offer of additional land so generously made by the Duke of Bedford. The plan of the proposed feeding experiments for the winter season of 1900-1, as prepared by Dr. Voelcker, had been approved. As the correspondence of the Consulting Chemist had brought to light several instances of deficiency of quality in the case of basic slag, the Committee thought it desirable to issue the following notice:—

At this time of the year, when purchases of BASIC SLAG are commonly made, it is well to advise members to be careful to stipulate for a definite guarantee as to percentage of phosphoric acid and degree of fineness of grinding. The recommendation of the Council on this point is as follows:—

**BASIC SLAG** to be guaranteed to be sufficiently finely ground that 80 to 90 per cent. passes through a sieve having 10,000 meshes to the square inch, and to contain a certain percentage of phosphoric acid, or its equivalent in phosphate of lime. (The highest grades range from 17 to 20 per cent. of phosphoric acid; medium grades, 14 to 16 per cent.; and low grades from 10 to 12 per cent. of phosphoric acid.)

As showing the advantage of submitting samples for analysis, an instance was brought to the notice of the Chemical Committee in which a member of the Society recently received compensation to the extent of 7l. 10s. on a purchase of 20 tons of basic slag, which was found on analysis to be deficient in quality and fineness of grinding.

### Botanical.

**Mr. WHEELER** (Chairman) reported that a considerable outbreak of disease, destroying the turnip crop over a considerable area in Yorkshire, having been brought under the notice of the Consulting Botanist during the recess, it had been considered desirable that Mr. Carruthers should personally visit the district. The injury was found to be caused by bacteria, which gained entrance to the bulb at the base of the young leaves in the centre of the crown. It penetrated the turnip, and at length converted the whole of the interior into a fetid pulp. A full account of the disease, with figures of the turnip and of the bacteria was being prepared for the next number of the Journal.<sup>1</sup> Dr. Voelcker had been recently engaged in experiments at the Pot Culture Station, on the possible eradication of certain weeds of the farm, and had obtained some interesting results. In the case of *wild onion* on arable land, an application of carbolic acid in January direct to the soil, where a patch of wild onion was growing, prevented the latter from coming up, and by the time that barley was sown the carbolic acid had been thoroughly removed from the top soil, so that no injury was done to the barley seed, and the crop thrived perfectly well, and no wild onion appeared among it. In regard to *wild poppy*, while spraying with sulphate of copper on the top side of the leaf did not check the growth of the weed, it was found that spraying on the under side of

the leaf with the same solution very largely checked the development of the wild poppy. These investigations were being continued.

### Veterinary.

**Mr. ASHWORTH** announced that a report had now been received from the Tuberculin Sub-Committee which had been appointed on May 31, 1899, to supervise the experiments then ordered to be carried out at the Royal Veterinary College in the direction of infecting healthy cattle of various ages with tuberculosis and then testing them, and an equal number of control animals, with tuberculin at various dates after infection, all the animals being subsequently killed and post-mortemed. The Report of the Sub-Committee, signed by Lord Brougham and Vaux, Sir Nigel Kingscote, S. George Brown, and Professor MacFadyean, would be printed in full in the next number of the Journal.<sup>1</sup>

The Veterinary Committee had had under their consideration a suggestion made by Mr. L. H. Becher Shand at the last Anniversary General Meeting, which he had subsequently expanded in a letter, with reference to the possibility of milk becoming infected with the germs of tuberculosis during its transit by railway. Mr. Shand had asked whether "germs might not be carried into the milk churns through their ventilators, and that in many cases the germs found on arrival were not in the milk when it left the farm," and had suggested that the Society should undertake an investigation as to whether "milk which was pure when it left the farm did not get contaminated while in transit by rail." The reply which had been agreed to by the Committee, after consultation with the Society's veterinary advisers, was as follows:—

1. It is obvious that milk (even absolutely pure milk and milk which has been effectually sterilised) is quite capable of being contaminated with tubercle bacilli or other infective organisms, unless means are adopted to keep it from contact with infective matter, which may be conveyed to it at any time by the atmosphere and in other ways. The Society is fully alive to the dangers to the public health which may

<sup>1</sup> See page 738 *et seq.*

<sup>1</sup> See page 708 *et seq.*

arise from the prevalent habit of expectoration by possibly consumptive persons on railway-platforms, highways, and other public places, and has co-operated with other public bodies in endeavouring to arouse public attention to this matter. The possibility must not, however, be excluded that sufficient care is not always taken on the farms where milk is produced to secure the most scrupulous cleanliness in the vessels containing the milk and in the returned empty milk-churns, as well as in all the surroundings of the milk on the farm, and of the cows themselves.

2. The Committee are advised that the holes in the cone in the centre of the lid of a milk-churn are essential to allow the escape of steam, vapour, or gases of any kind which may be disengaged from the milk during transit; but, in the opinion of the Society's scientific advisers, these holes are scarcely worth consideration as a means of the possible contamination of the milk through the agency of the air.

3. A more likely source of contamination is to be found in the too common practice of sending milk by railway in churns with loose lids. Milk which may be splashed out round the lids during a journey, or whilst the churns are being moved about railway-platforms, may wash away the dust and other impurities which accumulate on the surface of the lid, and may carry them back into the bulk of the milk in the churn; and in this way it is quite possible that tubercle bacilli might gain access to the milk in the churn through the medium of the dried excretions of consumptive persons in railway-stations, streets, or other public places.

4. This danger, however, may be guarded against by sending milk by railway in locked or sealed churns, the lids of which are tight. There appears to be still considerable misapprehension amongst farmers as to the willingness of railway companies to accept for transit over their lines milk-churns thus locked or sealed, although it is a regular practice by farmers serving some of the leading milk-distributing companies in the Metropolis. The railway companies have undoubtedly favoured the system of sending churns with loose lids, on the ground that examination of the contents by the railway officials was thus facilitated; but the Dairy Committee of this Society, having had their attention drawn to the matter, passed, on January 31, 1899, a Resolution "That the present custom of sending milk in unsealed churns is unsatisfactory, inasmuch as it exposes the farmer to the risk of having his milk tampered with during transit." Communications were opened with the railway companies, and an assurance was received that, at a meeting held at the Railway Clearing House on May 10, 1899, all the companies had agreed that they would not refuse to accept milk-churns "sealed," provided the conditions under which the companies accept such cans were adhered to. These conditions are thus defined in a letter addressed on October 12, 1899, by the Railway Companies' Association to the Assistant Secretary of the Railway Department of the Board of Trade:—

"Senders have for a long time been allowed to send milk in sealed cans; the companies accept the declaration of the

senders as to the quantity conveyed, no extra charge being made; the only condition the companies require to be fulfilled is that the tare weight of the cans shall be stamped upon the outside of the can, so that in case of doubt the quantity of milk within the churn can be approximately ascertained by allowing 10½ lb. for each gallon of milk declared. It does not appear to the companies that there is any difficulty in the senders protecting themselves against alleged loss of milk in transit by sealing, padlocking, or otherwise fastening their cans."

5. With regard to the investigation suggested by Mr. Sland as to whether "milk which was pure when it left the farm did not get contaminated while in transit by rail" (i.e. presumably that milk which has been ascertained before it leaves the farm to be perfectly free from the bacilli of tuberculosis should be tested for bacilli on its arrival at a railway station in a milk-churn, and again on its arrival at its place of destination) the Committee invite attention to the following paragraph in the leaflet on "Tuberculosis in Dairy Stock," issued by the Society in March 1899:—

"In a small proportion of cases tubercle bacilli may be detected in milk by microscopic examination, and such milk is always highly dangerous. It ought to be clearly understood, however, that failure to detect the bacilli by microscopic examination of milk is not reliable evidence that such milk is free from the germs of tuberculosis."

There are no means, short of inoculation or feeding animals, of deciding that milk is absolutely free from tubercle bacilli, and, as above stated, the failure to detect the organisms by the aid of a microscope does not prove that they are not present.

6. Whilst, therefore, fully alive to the importance of tuberculosis in its relations to dairy stock (a matter on which their veterinary advisers have for some time been engaged in experiments and inquiries), the Committee cannot, for the reasons above stated, see their way to undertake the particular investigation suggested to them.

With regard to the outbreaks of contagious disease amongst animals, Professor McFadyean had submitted to the Veterinary Committee the following report:—

**ANTHRAX.**—During the forty-three weeks of this year for which the returns have been published 446 outbreaks, with 760 animals attacked, have been reported. The figures for the corresponding period of last year were 442 and 855 respectively.

**GLANDERS.**—The returns with regard to this disease are very discouraging, the outbreaks already reported during the current year being 200 in excess of the number reported at the same date last year. The total number of outbreaks in 1899 was 682, whereas 944 outbreaks have already been reported this year.

**RABIES.**—This disease has unfortunately reappeared in South Wales, which was the last district to be relieved from the Muzzling Order at the beginning of the year. Five cases in dogs and two in other animals have

already been reported, and the Board of Agriculture has reimposed Muzzling Orders over an extensive area in the counties of Brecon, Carmarthenshire, and Glamorganshire.

*Swine Fever.*—The returns at this date show a decided decline, as compared with the same period of last year, the numbers being 1,859 and 2,064 respectively.

*Foot-and-Mouth Disease.*—Since this disease was detected in Suffolk at the end of January last, 17 outbreaks have been reported and confirmed by the Board of Agriculture, and, according to the Gazette Returns, the number of animals actually attacked in these outbreaks has been 237, viz., 175 cattle, 50 sheep, and 2 pigs. The number of animals slaughtered on account of exposure to risk of infection has not been published. The sequence of the outbreaks has been as follows:—The first occurred in Suffolk on the borders of Norfolk at the end of January. The next occurred in Norfolk in February, and in the same month the disease appeared in Bedfordshire. After an interval of a month it reappeared in Norfolk, on the marsha, and in May it was detected in Hertfordshire. No fresh outbreaks were reported in June and July, but in August the disease was discovered at places as far apart as the East Riding of Yorkshire and Flintshire in North Wales. In September an outbreak was detected on a farm in Wiltshire, and subsequently it spread to two neighbouring farms. The last outbreak occurred in Staffordshire, near Lichfield. That was on October 5th, and there is therefore some reason to hope that the country is again free from the disease.

*Research Laboratory.*—The number of morbid specimens forwarded to the Research Laboratory at the Royal Veterinary College during the third quarter of the year was fifty-three. During the same period outbreaks of abortion, ringworm, and ophthalmia (in cattle) have been investigated, and the experiments regarding horse-sickness have been continued.

### *Foot-and-mouth Disease.*

Earl SPENCER said no one who knew anything about the diseases of animals, or was interested in the subject, but would have viewed with great satisfaction the enormous progress which had in the past been made in stamping out foot-and-mouth disease. But in this life we were subject to disappointments, and he confessed that it had been a great and bitter disappointment to him to learn of the recurrence in many parts of the country of this disease, which was a source of loss and injury to farmers and stock-owners. They had present amongst them that day Sir George Brown, who had had unrivalled experience in that matter, and he (Lord Spencer) would like to ask whether it had been possible to trace the origin of the outbreak. So far he

had been unable to gather any information as to the origin of this disease in various parts of the country. The first outbreak was perhaps more easily accounted for, as it occurred near the sea coast; but as to the outbreaks in Yorkshire, Wales, and other parts of the country, he was at a loss to know what was the cause of them. He supposed that few of them would assert that foot-and-mouth disease sprang up spontaneously, though they might trace a certain similarity between one outbreak and another. A great variety of outbreaks had now arisen in different parts of the country, which had apparently no connection whatever with each other, and he should like some authoritative opinion on this matter. He sincerely trusted that with a firm administration of the law which had been passed with respect to this disease, they would be able in the future to maintain that immunity from contagious disease which it had been their good fortune to preserve in the past under the various Governments which had been in office. The matter was one of great importance to the agricultural world, and especially to the owners of animals in this country.

Sir NIGEL KINGSCOTE said he was so impressed with the singular fact that these outbreaks should have occurred in different parts of the country, far removed from one another, that he ventured, as Chairman of the Governors of the Royal Veterinary College, to seek an interview with Mr. Long, the President of the Board of Agriculture, on the subject. His object in doing this was not in the least to try and weaken the system adopted by the Board of Agriculture in stamping out this disease; but owing to the difficulty of tracing its origin, or of not tracing it at all, he had heard doubts expressed in several quarters as to whether it was really foot-and-mouth disease. In the case of an outbreak on a farm where the owner had pedigree stock, he suggested for consideration whether it would not be possible for strict isolation to be adopted, until it was proved by inoculation and diagnosis that the animals were actually suffering from foot-and-mouth disease.

Sir GEORGE BROWN said it would be absurd for him to attempt to deny that the whole course of the outbreak had been erratic in the extreme. The sudden appearance of the malady at places remote from any known centre was entirely contrary to anything which they had hitherto known of the history of the disease. It was true that in former times, in certain cases, great difficulty had been experienced in tracing the origin of an outbreak, and often no connection with a known centre of infection could be discovered; but in the present instance nearly all of the seventeen outbreaks had been surrounded by mystery. Notwithstanding this fact, however, the whole of the evidence critically examined left no escape from the conclusion that this was the genuine disease, seeing that clinically it had presented itself exactly as it had always done since it first appeared in this country in 1839. It was a curious fact that those who had had most experience in this malady, viz. some of the inspectors at the ports for foreign animals (men who had had extensive opportunities of seeing the disease in all its forms during half a century of its prevalence) had expressed themselves quite as much surprised as the owners of the animals at discovering that the disease was foot-and-mouth, and, indeed, were sure that it could not possibly be anything else.

Although he was no longer actively engaged in these investigations, he still took the greatest possible interest in them, and he had been told that the most careful and strict inquiry had been made in every instance. He could not, however, help expressing regret that more publicity had not been given to the facts which had been ascertained, because they tended to prove that the common impression among owners of stock that the affection was unlike foot-and-mouth disease, as it did not spread even in the herds in which it had broken out, was erroneous. In several cases which had come under his notice the infection had extended rapidly. He was not certain of the absolute correctness of the figures, but to the best of his recollection in one herd of fifty animals, two or

three of which were discovered to be affected, it was found that before slaughter could be completed twenty-seven of the cattle were suffering, and other similar cases had also been recorded.

In reference to Sir Nigel Kingscote's suggestion that inoculation or isolation should be employed to test the infectivity of the disease, he could understand that it would not be favourably received by the Board. It would naturally be urged that the work of a sanitary department was to stop the disease, and not to find out whether it would spread if they gave it the opportunity. There could not be any doubt that the measures which had been adopted had been very complete, for it was not unreasonable to state that in no case had the infection spread beyond the centres of origin, owing to the circumstance that the animals were at once shut up and killed as quickly as possible. With reference to the apprehension which was felt as to the serious losses which would arise if the disease broke out in a pedigree herd, he could not speak with any authority, but he might venture to say from his experience in the past that in such cases some plan would be devised to prevent the slaughter of a number of valuable cattle.

It had been proved that the disease in this country, though it had caused an enormous amount of injury, was not fatal like cattle plague or pleuro-pneumonia. Taking all the facts as they stood, he should have felt quite unable, even if he had been asked, to advise the Board of Agriculture to do otherwise than they had done. He admitted that the whole thing was a puzzle, but although the disease had taken an unusual course, he had no doubt himself that it was foot-and-mouth disease, and that the Board of Agriculture, by acting as they had done at every centre of infection, were taking the best means to get the disease out of the country as quickly as possible.

Mr. PHILL mentioned that a number of years ago, when the disease was prevalent in England, a case of foot-and-mouth was discovered in Warwickshire. Not very long after this case had been found, another case

broke out thirty-five miles away, on some land of his own in Northamptonshire. He felt quite certain that the contagion must have come amongst his cattle at one time or another. He discovered that some Ordnance Survey officers were then engaged in a survey of England in his district, and that when their survey was very nearly completed, some slight error in their work was discovered. He gathered that, to complete their work, the officials used upon his farm the same surface chain that had been employed by them in their duties on the farm in Warwickshire; and the fact remained that following upon the presence of the surveyors with that same chain again in Northamptonshire, after their visit to Warwickshire, foot-and-mouth disease was found. As to the means of eradication, he had no faith in any remedy but killing.

#### **Stock Prizes.**

Mr. SANDAY (Chairman) reported that the Committee had considered the draft prize-sheet for the Cardiff Meeting, together with a schedule of prizes prepared by the Local Committee, and had suggested certain modifications in the latter for the Local Committee's consideration.

The Committee recommended the acceptance, with thanks, of the offer of a number of champion prizes for competition at the Cardiff Meeting from breed societies.<sup>1</sup>

Mr. SANDAY added that a letter had been received by him on Monday from the Hon. Cecil Parker (whose other engagements prevented his personal attendance at the Stock Prizes Committee or the Council), suggesting for consideration that there should be jumping competitions at the Cardiff Meeting in connection with the classes for hunters and ponies. This letter had been laid before the Stock Prizes Committee (at a period of their proceedings at which—it was true—there was not a very full attendance), and the Committee were ready to give consideration to the details of the matter if the Council should approve the principle.

After some remarks by Mr. CRUTCHLEY, in opposition to the proposal,

Mr. RYLAND said that as it would appear that formal notice was necessary before this question could be brought before the Council for discussion, he wished to give notice that at the December meeting he would move that the Society offer prizes, under proper restrictions, for jumping competitions at the Cardiff Meeting next year.<sup>1</sup>

#### **Implement.**

Mr. FRANKISH (Chairman) reported that the Committee had approved the Implement regulations, and they had also considered the nomination of judges in the Implement Department for the Cardiff Meeting. Various matters relating to the late meeting at York had been brought before the Committee, and instructions given thereon.

#### **General Cardiff.**

Sir WALTER GILBEY reported that the Committee had discussed with the representatives of the Cardiff Local Committee the schedule of prizes for live stock, produce, &c. proposed to be offered by the Cardiff Local Committee, and had suggested various amendments thereto. The Local Committee had nominated Mr. Lewis, of Duke Street, Cardiff, as agent for the sale of season tickets; Messrs. John Isaac & Sons, Victoria Buildings, Millicent Street, Cardiff, as agents for the sale of produce; and Messrs. Stephenson & Alexander, of Cardiff, as agents for the letting of lodgings.

#### **Showyard Works.**

Mr. CRUTCHLEY (in the absence through ill-health of the Chairman, Sir Jacob Wilson) reported that the whole of the Society's plant had been removed from York, and stored on the site of the Cardiff show-ground, and that the entrances, superintendent's offices and stores had been erected there. The Committee had considered the question of the supply of refreshments for the meeting of next year, and recommended that

<sup>1</sup> For list of these prizes: see p. cxxiv.

<sup>1</sup> See post, p. ccll.

the Cambridge Catering Syndicate be again employed at the Cardiff Meeting, on the same terms as at York.

### Selection.

Sir JOHN THOROLD (Chairman) having presented the recommendations of this Committee as to filling up the vacancy on the list of Trustees caused by the lamented death of Sir John Lawes,

Sir JOHN THOROLD moved "That the Duke of Bedford, now a Vice-President, be elected a Trustee of the Society."

Mr. STANYFORTH said that it was his privilege as Chairman of the Chemical and Woburn Committee to second this resolution. It was, in his opinion, peculiarly appropriate that the vacancy caused by the death of the great investigator who had endowed the Rothamsted experiments should be filled by the appointment of the nobleman who was so generously subsidising this Society's similar experiments at Woburn.

This resolution having been unanimously adopted, it was moved by Sir JOHN THOROLD, seconded by Mr. ASHWORTH, and unanimously resolved, "That the Earl of Derby, K.G., be elected a Vice-President of the Society."

The vacancies on the Council created by the appointment of the Earl of Derby as Vice-President and the death of Mr. Samuel Rowlandson were reported to be under the consideration of the Committee of Selection.

Sir JOHN THOROLD, in formally moving, pursuant to notice,

That Bye-law 8, as to the number of honorary members of the Society, be amended by the omission from line 7 of the words "twenty-five," and the substitution therefor of the words "fifty, of whom not more than twenty-five may be British subjects,"

said that occasions sometimes offered themselves in which the Committee of Selection desired to confer the honorary membership of the Society upon distinguished persons, and they had been prevented from doing this

at the right time by the limitation enjoined by the present Bye-laws. It would be a great convenience if the maximum were increased to fifty, and he therefore moved the resolution standing in his name.

This was seconded by Sir NIGEL KINGSNOTE, and carried unanimously.

### Education.

Lord MORETON (Chairman) reported that, following the precedent of previous years, examinations for the National Diploma in Dairying had been held this year for English students at Reading College and the British Dairy Institute, Reading, from September 24 to 27, 1900, and for Scottish students at the Dairy School, Kilmarnock, from October 1 to 3. The examinations in general Dairying and Cheesemaking were conducted at both centres by the same examiners, as last year (Mr. John Gilchrist and Mr. W. McFadyean), different examination papers being set for each centre. The examination in Chemistry and Bacteriology was conducted at Reading by Dr. J. Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society of England, and at Kilmarnock by Dr. A. P. Aitken, Consulting Chemist to the Highland and Agricultural Society of Scotland. Nine candidates entered and were examined at Reading; six of them had satisfied the examiners, and had therefore been awarded the National Diploma in the Science and Practice of Dairying. Eight candidates had entered, and seven were examined at Kilmarnock, and of these five were successful.<sup>1</sup>

These dairying examinations had now been held for five years; and the opinion of those immediately concerned in their supervision was that the quality of the practical work done, and of the written answers to the papers of questions, tended to improve, and that fewer candidates than before entered themselves for the examination without preparation or previous study.

Various accounts incurred in con-

<sup>1</sup> For list of the successful candidates see p. 708.

nection with the examination at Reading had been passed, and referred to the Finance Committee for payment. The National Agricultural Examination Board, on which this Committee was represented by six members, had held their annual meeting on October 11 last, and had settled the details of the regulations and syllabus for the examinations of 1901 in Agriculture and in Dairying. Copies of these regulations were laid upon the table.<sup>1</sup>

### **Dairy.**

Mr. DUGDALE (Chairman) reported that the Committee had amended and passed the produce portion of the prize-sheet for the Cardiff Meeting. The question of the possible contamination of milk during its transit by railway, which had been the subject of suggestions made by Mr. L. H. Becher Shand and Mr. G. D. Yeoman, at the last anniversary meeting of Members, had been further considered by the Committee, who had expressed their concurrence in the statement of the case drawn up by the Veterinary Committee for the approval of the Council.

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<sup>1</sup> For text of Regulations, see pages ccxx-ccxxii.

### **Notices as to Annual Grants.**

Notice was given on behalf of the several committees of their intention to move at the next meeting of the Council for the following grants for 1901: Chemical Committee, £200 for pot culture experiments; Veterinary Committee, £600, of which £500 to be allocated to the Royal Veterinary College; Education Committee, £400 for the Examinations for the National Diploma in Agriculture and Dairying and for other purposes.

### **Miscellaneous.**

Sir NIGEL KINGSCOTE mentioned that, though the Special Show Committee had no report to submit on that occasion, they made a certain amount of progress during the recess in examining and considering sites in the neighbourhood of London suitable and available for a permanent Showyard for the Society.

The SECRETARY announced that the Society had been awarded a Grand Prix at the Paris Exposition for its exhibit of specimens of cereals grown in England.

Various other matters having been dealt with, the Council adjourned until the Wednesday of the Smithfield Show week (December 12).

WEDNESDAY, DECEMBER 12, 1900.

EARL CAWDOR (PRESIDENT) IN THE CHAIR.

**Present:**

*Trustees.*—Sir Walter Gilbey, Bart., Colonel Sir Nigel Kingscote, K.C.B., Sir John H. Thorold, Bart.

*Vice-Presidents.*—Mr. H. Chandos-Pole-Gell, the Earl of Coventry, Lord Moreton, the Hon. Cecil T. Parker, Mr. Charles Whitehead, Sir Jacob Wilson.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. Alfred Ashworth, Mr. R. C. Assheton, Lord Brougham and Vaux, Mr. F. S. W. Cornwallis, Mr. Percy Crutchley, Lieut.-Colonel Curtis-Hayward, Mr. A. E. W. Darby, Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. W. Frankish, Mr. R. M. Greaves, Mr. R. Neville Grenville, Mr. James Hornsby, Mr. John Howard Howard, Mr. Henry D. Marshall, Mr. Joseph Martin, Mr. T. H. Miller, Mr. J. E. Ransome, Mr. Frederick Reynard, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. Alfred J. Smith, Mr. Henry Smith, Mr. E. W. Stanforth, Mr. R. Stratton, Mr. Martin J. Sutton, Mr. Garrett Taylor, Mr. E. V. V. Wheeler, Mr. J. C. Williams, Mr. C. W. Wilson.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

Professor Sir George Brown, C.B., Professor McFadyean.

The following members of the Cardiff Local Committee were also present:—Mr. D. T. Alexander, Mr. Robert Forrest, Mr. Henry Lewis, Mr. J. L. Wheatley.

Apologies for non-attendance were received from the Marquis of Granby, the Earl of Derby, K.G., the Earl of Feversham, Viscount Baring, Lord Arthur Cecil, Lord Middleton, Mr. Victor C. W. Cavendish, M.P., Mr. Albert Pell, Mr. J. P. Terry, Mr. R. A. Warren.

The minutes of the last monthly meeting of the Council, held on November 7, 1900, having been taken as read and approved, the election of the following seventeen members was proceeded with:—

**Election of New Members.**

ADAMS, Wm. R. Goold..Jamesbrook, Ballincourra, co. Cork.  
BLAKE, J. R. Scott..Stone, Blackwater, Isle of Wight.  
BRACK, Robert Wilson..Bowesfield, Stockton-on-Tees.  
CLANCY, J. C...87 Cheape Road, Cant., Rangoon, Burma.  
CLINCH, Joseph..Edgehill, Minchinhampton, Glos.  
CRIPPS, L. N. B...Ampney Park, Cirencester.  
GOOCH, Sir Thomas V. S., Bart...Henstead Hall, Wrentham, Suffolk.  
JONAS, Harry Marshall..27 Market Hill, Cambridge.  
JONAS, Samuel Marshall..27 Market Hill, Cambridge.  
LOUBSER, Matthew M...Port Elizabeth, South Africa.  
LOVELL, A. E...Harpole, Northampton.  
MCALL, James McL., M.R.O.V.S...4 Whitehall Place, S.W.  
MRDD, John C...Stratton, Cirencester.  
PARKS, George..Oswestry.  
POPE, Andrew W. W...Upton Bishop, Ross, Herefordshire.  
POTTER, L. Haaloch..Riverside, Lechlade, Glos.  
SPRAKMAN, Philip Ernest, J.P...The Manor House, Boughton.

The Reports of the various Standing Committees were then presented and adopted, as below:—

**Finance.**

Sir NIGEL KINGSCOTE (Chairman) reported that the accounts for the month of November, 1900, as certified by the Society's Accountants, showed total receipts amounting to 652*l.* 5*s.* 9*d.*, and expenditure to 1,185*l.* 1*s.* 11*d.* Accounts amounting in all to 3,134*l.* 15*s.* 8*d.* had been passed, and were recommended for payment. The Committee recommended that Lloyd's Bank, Limited, of Cardiff, be appointed local bankers, and that Mr. W. Frankish and Mr. F. S. W. Cornwallis be appointed Stewards of Finance for the Cardiff Meeting. The Secretary had laid upon the table the statement

of receipts and expenditure of the York meeting, as finally passed by the Auditors on December 3, showing a debit balance of 3,464*l.* 17*s.* 8*d.* In view of the fact that the date of publication of the Journal for 1901 had not yet been settled, the Committee thought it would be well to publish this financial statement in the number to be issued at the end of December.<sup>1</sup> The Committee had met nine times and presented nine reports during the year.

#### House.

Sir NIGEL KINGSOTE (Chairman) reported that various accounts connected with the Society's house had been passed, and referred to the Finance Committee for payment. The Committee had met seven times and made five reports during the year.

#### Journal.

Sir JOHN THOROLD (Chairman) reported that several accounts connected with the Journal had been passed and were recommended for payment. Copies of the pamphlet by Mr. S. B. L. Druce on the Agricultural Holdings Act, which had been reprinted from the September number of the Journal, were laid upon the table. The Committee had further considered the question of the future issue of the Journal, and had unanimously agreed to recommend to the Council that after the conclusion of the current volume the Journal of the Society should be issued once a year in a volume suitably bound, with the full reports, as before, of the Council and the Society's scientific advisers, and with articles by expert writers on matters which appeared to be of permanent interest and of value for reference. Any reports or memoranda of immediate importance would, however, be communicated as soon as available to the agricultural and general press, and circulated amongst members who might from time to time express a wish to have them. As that was the last occasion on which Dr. Fream would attend the Council as Editor of the Journal, the Committee wished to take the opportunity of expressing their high sense of the Editorial work done for

the Society by Dr. Fream, not only in connection with its Journal, but also in the compilation of its Text-book on the Elements of Agriculture. The Committee had met eight times and made eight reports during the year.

#### Chemical and Woburn.

Mr. E. W. STANYFORTH (Chairman) presented the annual report for 1900 of the Consulting Chemist, which was ordered to be published in the next number of the Journal.<sup>1</sup>

The Committee asked for a renewal of the grant of 200*l.* for the purposes of the Pot Culture Station at Woburn for the year 1901. They had met eight times and made eight reports during the year.

Dr. Voelcker had presented the following report on cases of adulteration, which had come under his notice:—

#### REPORT OF CONSULTING CHEMIST.

##### I.—Compound Cake with excess of Sand.

A member resident near Luton, Beds., sent on October 24 a sample of compound fattening cake for analysis. Dr. Voelcker's report upon this was:—

	October 31, 1900
Moisture . . . . .	11.65
Oil . . . . .	9.82
*Albuminous compounds (flesh-forming matters) . . . . .	17.68
Starch, sugar, and digestible fibre . . . . .	40.06
Woody fibre (cellulose) . . . . .	3.59
†Mineral matter (ash) . . . . .	11.20
	100.00

\* Containing nitrogen . . . . . 2.83  
† Including sand . . . . . 4.45

"A cake made from materials not properly clean. It has a large excess of sand, a good deal of weed seed, is very highly spiced, and is altogether an unsatisfactory cake."

The member had purchased 4 tons of this cake, at the price of 7*l.* per ton delivered, through the local agent of a Liverpool firm. On complaint being made to the local agent, the latter called to take samples from the bulk. These were submitted to another analytical chemist, and the results agreed closely with those of Dr. Voelcker; the sand, indeed, being rather higher, namely, 4.75 per cent. The vendors undertook to remove the cake and pay all costs.

##### II.—Pea Meal adulterated with Maize Meal.

A member of the Society sent on November 1 a sample of pea meal. Upon this Dr. Voelcker reported on November 9:—

"I have examined the sample of pea meal submitted by you, and have to report that it is not pure, but is adulterated with maize meal."

##### III.—Basic Slag.

The Chemical Committee, in their report last month (November, 1900), took occasion

to draw attention to the deficiencies of quality not infrequently found in the case of purchases of basic slag, and to advise members to check deliveries by having samples analysed. Out of thirty-one samples of basic slag which have been sent of late, in nineteen cases the guarantee was reached, in one case there was no guarantee given, and in no less than eleven instances was there shown deficiency of quality, fineness of grinding, or the two together.

#### A.—Deficiency of Fineness of Grinding.

In one instance (Case No. 1) a fineness of 80 per cent. had been guaranteed; the sample analysed showed 74 per cent. "fineness" only. An allowance of 1s. 6d. per ton was made.

#### R.—Deficiency of Quality.

	Case No. 2	3	4	5	6
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Quality guaranteed:					
Phosphoric acid	18-20	18-20	—	—	—
Phosphate of lime	—	—	38-45	38-45	38-45
Quality supplied:					
Phosphoric acid	16-45	16-93	—	—	—
Phosphate of lime	—	—	28-53	29-38	37-02
Allowance made per ton	3s. 8d.	2s. 6d.	10s. 3d.	12s.	1s. (Claimed.)

#### C.—Deficiency of Quality and Fineness.

	Case No. 7	8	9	10	11
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphate of lime, quality guaranteed	30-35	38-45	(?)	(?)	38-45
Quality supplied	24-45	23-75	32-85	33-19	35-88
Fineness guaranteed	80	80-90	(?)	(?)	85-90
Fineness supplied	73-8	77	82	82-5	84-25
Allowance made per ton	7s. 6d.	10s.	3s. 1d.	2s. 7d.	3s. 2d. (Claimed.)

J. AUGUSTUS VORLICKER.

December 11, 1900.

### Botanical and Zoological.

Mr. WHEELER (Chairman) reported that the Committee had considered the Annual Reports of the Consulting Botanist and the Zoologist, and recommended their publication in the next number of the Journal.<sup>1</sup> The Committee had met eight times and made eight reports during the year.

### Veterinary.

The Hon. CECIL T. PARKER (Chairman) reported that the Committee had accepted, with thanks, the offer of the Worshipful Company of Farriers to present the freedom of the Com-

pany to the first-prize winners in the horse-shoeing competitions at Cardiff. They had also settled other points connected with the horse-shoeing competitions, and the arrangements for the veterinary examinations at Cardiff. They asked for a renewal of the annual grant of 600*l.*, of which 500*l.* would be allocated to the Royal Veterinary College. The Committee had met eight times and made eight reports during the year.

Professor McFadyean had presented the following report:—

**ANTHRAX.**—During the last four weeks 35 outbreaks, with 46 animals attacked, have been reported. The corresponding figures for last year were 32 and 47 respectively.

**GLANDERS.**—During the same period 63 outbreaks, with 125 animals attacked, have been reported, as against 60 outbreaks and 97 animals attacked in the corresponding four weeks of last year.

**RABIES.**—Two cases of this disease in animals other than dogs, were notified during the week ended November 17.

**SWINE FEVER.**—During the last four weeks 34 outbreaks have been reported, as against 32 in the corresponding period of last year.

**MISCELLANEOUS.**—The number of morbid specimens forwarded to the Research Laboratory for examination during the month of November was 42, including cases of tuberculosis, glanders, anthrax, black quarter, acorn poisoning, &c. Three cattle suffering from parasitic gastritis, and from different farms, have been brought to the College for experimental treatment.

The reports and specimens that have reached the Laboratory show that very serious losses from acorn poisoning have been caused in different parts of the country. Such losses may be said to be of steady annual recurrence, and it is obvious that the danger in this connection is not so well known to stock-owners as it ought to be.

### Stock Prizes.

Mr. SANDAY (Chairman) reported that the Committee had considered, and finally approved, the prize-sheet for the Cardiff Meeting, and recommended its adoption and issue forthwith. They had also considered letters relating to offers of prizes by breed societies for the Cardiff Meeting, and had given instructions for replies thereto. Various offers of champion prizes from breed societies had been accepted with thanks.<sup>1</sup> The Committee had considered replies received from the Flock Book societies and sheep-breeders' associations on the subject of the colouring of sheep, but as it appeared that there was no

<sup>1</sup> See pages 731 and 742.

<sup>1</sup> For a list of such prizes, see page cxciv.

general consensus of opinion in the matter, they did not recommend that any action should, at present, be taken by the Council. The Committee had met eight times and had made eight reports during the year.

[The total value of the prizes, exclusive of champion prizes and medals offered by the various breed societies, is 5,889*l.*, to which the Cardiff Local Committee contribute the amount of 712*l.*, and various breed societies 353*l.* The distribution of prizes is as follows:—

	£	s.	d.
Horses . . . . .	1,695	0	0
Cattle . . . . .	1,778	0	0
Sheep . . . . .	1,332	10	0
Pigs . . . . .	396	0	0
Poultry . . . . .	252	0	0
Produce . . . . .	209	0	0
Horse-shoeing . . . . .	32	0	0
Hives and Honey . . . . .	38	10	0
Timbering and Rope Splicing . . . . .	21	0	0
Implements . . . . .	135	0	0
	£5,889	0	0]

*Prizes for Lincolnshire Red Short-horns.*

Sir JACOB WILSON said that before the report of the Stock Prizes Committee, involving the approval of the draft prize-sheet for Cardiff, was adopted by the Council, there was one matter to which he felt bound to call their attention. Through circumstances over which he had no control he was unable to attend the meetings of the Stock Prizes Committee either in November or December; and he was bound to say that when he looked through the draft prize-sheet he was taken very much by surprise to find that it was contemplated to offer prizes at the Cardiff Meeting for two varieties of Shorthorn cattle, necessitating two Shorthorn rings and two sets of Shorthorn judges.

Mr. SANDAY rose to a point of order, this question having been settled at the last meeting of the Council.

Sir JACOB WILSON said that he understood that the settlement of the prize-sheet as a whole was before the Council for discussion, and as that was the first opportunity he had had of expressing his opinion in the matter, he hoped he might be permitted to do so then.

Some discussion arose as to whether

Sir Jacob Wilson was entitled to raise the question then, in view of the recommendation presented by the Stock Prizes Committee in November, and adopted by the Council, for the acceptance of these prizes.

Mr. FOSTER said that he had requested at the November meeting of the Stock Prizes Committee that his objection to the proposal should be noted, and he did not raise any formal opposition at the November Council because he understood that the whole question of the composition of the prize-sheet would be discussed, as usual, in December.

Sir JACOB WILSON observed it had always been their practice that, whatever had taken place previously, the December Meeting of the Council was the final occasion upon which the settlement of the prize-sheet was discussed.

The PRESIDENT pointed out that the recommendation of the Stock Prizes Committee on this subject had been submitted to and adopted by the Council at their last meeting; and the matter would seem therefore to be concluded. But as it appeared that Sir Jacob Wilson and others had come to the meeting believing that the whole of the prize-sheet was subject to revision by the Council that day, he would not then press his own opinion in the matter.

Sir JACOB WILSON (resuming) said that, as he had pointed out, the Council were proposing to offer prizes for two varieties of Shorthorn cattle, which would necessitate two Shorthorn rings and two sets of Shorthorn judges. He did not know whether the question had arisen in the mind of the Chairman of the Stock Prizes Committee as to whether the Society might contemplate the offering of prizes for other varieties of Shorthorns and other breeds. No doubt he would be told that the Lincolns were a pure breed of cattle, but he took exception to that statement. Two years ago a commission was sent North from Lincolnshire to buy a number of Shorthorn bulls, and that took away the probability of this being a pure and distinct breed. Again, he might be told that the Lincolnshire Red Short-horn Association had a Herd Book of its own, which had been pub-

lished. He held in his hand the first volume of that Herd Book, from which it appeared that the Association was not formed until May 17, 1895. He took it that the entries for this Herd Book could not have been received much before the end of that year, so that the book could not be published until the end of 1895 or the beginning of 1896. There was a rule of their Society which enabled them, after a certain number of years, to admit cattle entered in a Herd Book as a pure breed. That limit was seven years, and he maintained that so far as the question of time was concerned the Lincoln Herd Book did not comply with the conditions of their Society, and it would not be until the end of 1902 that animals entered in this Herd Book could be admitted to the Society's shows. He believed that it had always been recognised and understood that a Stud, Herd or Flock Book issued by a Society should be a guarantee of the purity and distinctiveness of the breed which it professed to represent. Now in the first volume of the Lincolnshire Red Short-horn Herd Book (page 80, No. 20) he found a bull entered with the Coates's Herd Book number 62190; another (No. 44) with the C.H.B. number 63741; another (No. 55) 60441 (C.H.B.), and a fourth (No. 126), No. 62653 (C.H.B.). Further, he was informed that there were many bulls entered in the Book which were of pure Shorthorn blood, with the Lincolnshire number attached to them. The members of the Lincolnshire Agricultural Society held a show at Sleaford on July 11, 12, and 13, 1900, and in the catalogue he found two distinct classes entered, one of the Shorthorn breed and the other Lincolnshire Red. "Royal Burton," entered in the Shorthorn Herd Book, and another animal, also called "Royal Burton," entered in the Lincolnshire Herd Book, were exhibited; and he found that they were identically the same animal entered in two classes. He found that in 1898 the authorities of the Lincolnshire Red Short-horn Association had arrived at the conclusion that the time had come when they ought to do something more to improve the purity of their breed, and

they passed the following resolutions:—

"That no bull calved on or after January 1, 1898, shall be eligible for registration in the Herd Book of this Association whose dam had not been registered or included in a registered herd of the Association, and whose sire is not eligible for use as a sire or registered in the Herd Book of this Association.

"No bull which is eligible for registry in Coates's Herd Book will be accepted for registry in the Herd Book of the Lincolnshire Red Short-horn Association, unless it be directly descended from a cow or heifer registered in the Herd Book of this Association."

In addition to the above a further paradoxical rule was passed, viz.:—

"Red bulls entered or eligible for Coates's Shorthorn Herd Book may be used, and their produce accepted for registry," &c.

After what he had read to the Council, he failed to see how the Royal Agricultural Society could recognise this as a separate breed when it had been proved by the Lincolnshire authorities that the Society's requirements, first as to the establishment of a Herd Book, and secondly, as to the purity of a Red animal shown in a Red class, could not be complied with. It was not enough to be told that the money question did not affect the Society, as the funds were provided for these prizes by the Herd Book Association, and that, therefore, presumably, they could do as they pleased. It had always been held in that Council that whether prizes were offered by the Royal Agricultural Society or were provided from outside sources, animals could only be exhibited under the rules and conditions of this Society, which ought in no way to be passed over. They were told that their misfortunes of recent years were due to the enormous dimensions of their showyard, and yet they were prepared to add new classes to the prize-sheet. The selection of Cardiff as the first place for the exhibition of this breed, as far as possible from its native county of Lincoln, seemed to him somewhat remarkable. It was opening a door, and a dangerous door, which might afford opportunities for the smuggling in of other herds.

The discussion was continued by Sir NIGEL KINGSFOTE (who expressed a hope that prizes would not be ac-

accepted by the Society for a newly-established breed of this kind), Mr. DUGDALE (who pointed out that the Society accepted prizes for Polo ponies, whose Stud Book had not been in existence for seven years), Mr. SANDAY, Sir WALTER GILBEY, Mr. FRANKISH, and others.

In reply to a question as to the effect of the Society's bye-laws and regulations upon the point under debate,

The SECRETARY explained that the only "bye-law" governing the Society's prize-sheet was a Standing Order passed in December, 1875, and reaffirmed in March, 1886, that "the prize-sheet for the Country Meeting shall be settled at the Council Meeting in December." Since the Preston Meeting of 1885, each year's prize-sheet had contained a regulation with regard to cattle that "every animal entered for competition must be entered, or certified as eligible to be entered, in the Herd Book of its breed, where such Herd Book exists and has been in existence for not less than seven years." The effect of this regulation was not to exclude from the prize-sheet classes for animals of breeds for which there was no Herd Book, or for which the Herd Book had not been in existence for a stipulated period, but to prevent the acceptance of entries of animals of a particular breed which were not entered in the Herd Book, if for such breed there was a Herd Book of seven years' standing.

Mr. STRATTON was sorry to differ from Sir Jacob Wilson and Sir Nigel Kingscote, but he did not see that the Shorthorn Society could claim any monopoly with regard to Short-horns. They would be aware that there were a good many cattle in this country which passed as Shorthorns though not eligible for the Herd Book. If the Lincolnshire Association, which had been established for a specific purpose, chose to give prizes for their breed, he did not see on what principle they could object to the inclusion in the prize-sheet of the classes at present under discussion, seeing that the Royal Society had allowed animals which were not entered in any Herd Book to be exhibited at their shows. There was no reason why

animals entered in a Herd Book should not be shown, even if the Herd Book had not been in existence for seven years, according to the present regulations. Sir Jacob Wilson had referred in terms of reproach to the fact that animals appearing in the Lincolnshire Herd Book could be traced back to Coates's Herd Book; but to his mind this was evidence that they were using their best endeavours to improve their breed of cattle. As far as he (Mr. Stratton) could see, no adequate reason had been given for the exclusion of the prizes for this particular breed of cattle.

Mr. MARTIN said that something had been said about a new departure, but as the money was found by the Lincolnshire Short-horn Association he thought it would be very ungracious and discouraging to a young Society to refuse them.

Mr. HORNSBY said he was of opinion that these prizes should be accepted, as he feared that if the Lincolnshire Red Short-horns were prevented from being exhibited, it would be a discouragement to agriculturists. It appeared to him that the proposal to decline these prizes was based on the fears entertained by the Shorthorn Society from the competition of the Lincoln Red animal.

Lord MORETON said that, speaking as a member of the Council of the Shorthorn Society, that Society did not fear competition, but what they wanted to discourage was the exhibition of mongrel breeds.

The PRESIDENT said that, as Chairman of the meeting, he felt some doubt as to whether he ought to allow any motion on the subject to be put to the vote. At the November Meeting certain recommendations of the Stock Prizes Committee had been formally put before the Council, and had been formally received and adopted; and on the strength of the sanction then given those recommendations had been incorporated in the prize-sheet. He was told, on the other hand, that by custom the formal motion for its adoption threw open the whole prize-sheet for discussion and amendment, in spite of the full debate which had already taken place

before the Stock Prizes Committee. If members of Council who, for whatever reason, had been absent from the deliberations of a Committee or of the Council, were permitted to come in at the eleventh hour and without notice to upset previous decisions of the Council, grave inconvenience would result. He thought that the whole matter of the presentation of the prize-sheet to the Council for its approval needed to be carefully considered; and on the present occasion, though he intended to allow an amendment to be put, he wished to say that he did so under protest, and without considering himself bound by the decisions of former occupants of the Chair.

Sir NIGEL KINGSCOTE then formally moved, and Mr. ASHWORTH seconded, the following amendment:—"That the prizes offered by the Lincolnshire Red Short-horn Association for Lincolnshire Red Short-horn cattle be not accepted."

This amendment was lost by twenty-four votes to twelve, and the original motion for the adoption of the prize-sheet, as submitted by the Stock Prizes Committee, was carried *nem. dis.*

#### *Jumping Competitions at Cardiff.*

Mr. HOWARD RYLAND said that, owing to the unavoidable absence from the November Council Meeting of the Hon. Cecil Parker, who had raised, by a letter to the Chairman of the Stock Prizes Committee, the question of the "offer of prizes, under proper restrictions, for jumping competitions at the Cardiff Meeting," he had thought it right to place a motion upon the agenda paper for that day, with a view to elicit a definite expression of opinion from the Council on the subject. The idea of the introduction of jumping competitions had been in the mind of several members of the Council for a considerable time; and the Society's recent financial reverses had made the time opportune for a discussion on the question of how to make their shows more attractive to the public. So far as he could ascertain, this question of having horse-jumping competitions at the shows had never been academically discussed in the

Council of the Society, and, therefore, he thought he might say that there had been no definite declaration against it. He found that jumping competitions had been allowed at the Manchester Show of the Society in 1869, on which occasion the Council gave permission to the Local Committee to make independent arrangements whereby they were able to hold such competitions in an enclosure adjoining the Society's showyard. After reciting that a separate entrance was made to the enclosure in which the competitions were held, that a separate entrance fee was charged, that they proved to be very attractive, and that they were the means by which some of the heavy expenses to which they had been put were reimbursed to the Local Committee, the late Mr. W. Wells, M.P., the Senior Steward, in his report on the exhibition of live stock at the Manchester Meeting of 1869, added:—"Notwithstanding, however, the financial success which attended this exhibition of horse jumping, it is very questionable whether it is advisable for the Royal Agricultural Society to allow the same thing another time. It was impossible at Manchester, and would always be impossible, to make the public understand that the Society had nothing whatever to do with the proceedings, and it leaves the Council open to the charge of encouraging, for the mere sake of money-making, what, after all, partakes more of the nature of a circus than of any part of an agricultural society's show." He (Mr. Ryland) ventured to say that he believed that Mr. Wells's employment of the hackneyed phrase "of the nature of a circus" was meant merely as a figure of speech. The conclusion that he drew from these remarks was that the financial result of their show at that time was so satisfactory that there was no need to try and create other attractions for the public. But the times had altered, and the Society must go with them. What did they find now that the Chairman of their Finance Committee had been obliged to say to them at their last Meeting? In his very temperate but most important statement made to the Council in November

last, Sir Nigel Kingscote felt compelled to emphasise the fact "that the enormous risk on the shows which the Society now ran was not one which the Finance Committee could look upon with complacency."

No doubt exhibitors of live stock and implements, who reaped the greatest amount of benefit from the Society's annual exhibition, would, if called upon, be ready to meet the Society's reasonable demand to share in the large and increasing expenditure. But he thought that before that expedient was adopted, they would want to know that the Society had endeavoured by every constitutional means to make its shows attractive; for it must not be overlooked that unless the public could be attracted to the show, the exhibitors themselves would not feel that they had a good opportunity of doing business. For this reason of drawing visitors to their show, he ventured to ask the Council that day to adopt the resolution standing in his name. He did not suppose that horse-jumping would be sufficient in itself to maintain big attendances at their shows, and he would welcome any other beneficial proposal that would add to the interest of the show, and bring the people to the gates. If he had failed to state the case so as to realise the objections of those members of Council who by tradition and sentiment were not in sympathy with it, he would ask them not to lose sight of the yearly difficulty of arousing sufficient outside interest to draw the public to the show, so as to make it, as it ought to be, as far as possible self-supporting. This could only be done by the provision of a supplementary exhibition which would excite the public interest. The Council must—if he might say so—thaw, and adapt the show to meet the changing taste of the public, upon whom the Society was dependent for its support, and of whom 90 per cent. had only an indirect interest in agriculture, and who only attended their meetings for pleasure and to be entertained. With regard to his suggestion that these jumping competitions should take place at the Cardiff Meeting next year, he might

say that the Local Committee thought it was desirable to have them, and that they were prepared to augment from their local fund any prizes given by the Society towards jumping.

The Hon. CECIL PARKER said that, as he was responsible for raising the question, he cordially seconded Mr. Ryland's motion. Members of Council would be aware, from the statement made by Sir Nigel Kingscote at the November meeting, that the coffers of the Society had been very much depleted by the recent losses on the shows, and it behoved them to try and get some money into them again as quickly as possible.

Mr. CRUTCHLEY said that he had listened very carefully to the two previous speakers, and had failed to catch one word which had fallen from them as to how it would be possible to provide "proper restrictions" for the regulation of these competitions. If it were practicable to have jumping founded on the lines upon which they had endeavoured to carry out their shows in the past, it would then perhaps be desirable to have these competitions. But he thought it would be advisable to consider what were the principles upon which the Council had endeavoured to arrange its exhibitions. Certainly their chief object had not been to provide amusement for the public, but to interest the public in all that affected and all that was best in agriculture, especially as regards live stock, implements and produce, and to promote the interests of the agricultural community at large. So long as any proposals kept within these limits the Society had always welcomed and accepted them, but he did not think they could accept this particular proposal without lowering the standard of exhibition which the Society had endeavoured to maintain in the past. He had not touched upon the money question. No doubt it was true that they might collect more money by having these jumping competitions through attracting a certain number of additional people to the showground. But something more in the way of details ought, in his opinion, to be laid before the Council before they were asked to

appoint a Sub-Committee to try and invent these "proper restrictions." He did not want to see in their show-yard the professional jumpers which frequented the county shows.

Mr. CHRISTOPHER WILSON said that jumping competitions answered exceedingly well at small shows in the country, and had been a conspicuous success at the Royal Show at Manchester in 1869.

Mr. NEVILLE GRENVILLE, as a showman of thirty years' standing, was personally averse to jumping competitions, but there was no doubt that they attracted the public, and he thought the Society should move with the times. What they wanted was gate-money, and jumping competitions would certainly be a means of getting it. He had known Cardiff and Cardiff people all his life, and felt sure that they would do everything in their power to conduct these competitions in the proper way. For these reasons he intended to vote for the holding of the competitions.

Sir WALTER GILBEY remarked that, speaking from the experience gained by having been associated with shows for the past forty years at the "Royal" and elsewhere, he did not believe for a moment that the Horse Show which formerly took place in the summer at the Agricultural Hall was of much benefit to the breed, but it provided the funds necessary to carry on the work. He remembered that the show of the Essex Agricultural Society used to be a somewhat quiet affair, but since jumping competitions had been introduced people attended it in thousands. The same kind of argument was brought forward when it was first proposed to have a military band in the "Royal" showyard. It was contended that music had no connection with agriculture; but people interested in agriculture liked music, and on the same principle he did not think that any discredit whatever would fall upon the Society by having these jumping competitions at Cardiff. He knew that the people of Cardiff were very anxious that jumping should take place; and he should certainly support the resolution, with which he was very much in sympathy.

Colonel CURTIS-HAYWARD said

that if they could get Hunters to go over fences he should be in favour of supporting the motion; but, in his opinion, they would do nothing of the sort, but would only get a number of "old screws" from all parts of the country.

Mr. RANSOME, as an implement exhibitor, said that, personally, he should deprecate the introduction of an additional attraction at the other end of the yard, which would tend to draw visitors from the implement section of the showground; but still he would support most heartily any proposition that would be likely to help the Society's finances.

Mr. STRATTON said that in the financial interests of the Society he should vote for the motion, and he did not think it at all inconsistent with the principle always adopted by their Society, viz. that its shows should be for the improvement of stock in one form or another. It ought, however, to be clearly understood that these competitions should be confined to Hunters, and it was only on this understanding that he intended to vote for the motion. Why should not Hunters jump? In his part of the world it was usually considered a necessary accomplishment. With regard to horses which could not jump, they might be interesting as a spectacle, but he thought the Council would be doing real good by encouraging the teaching of Hunters to jump. He certainly thought that the competition should be confined to Hunters, for he objected altogether to the roaring acrobatic performers that went about the country.

Sir NIGEL KINGSCOTE hoped the Council would carefully consider the importance of the step they were taking if they adopted this motion. He quite agreed with Mr. Stratton that it would be a great advantage if Hunters over four years old were trained to jump. By doing this, the Society would accomplish a more useful work than by encouraging mountebanks to jump over a dozen fences on "old crocks" that went all round the country.

After some further discussion, the resolution was put to the meeting and carried on a show of hands by twenty-two votes to thirteen.

The further consideration of the matter was remitted to a Sub-Committee to prepare a detailed scheme of prizes and regulations for submission to the Council at a future meeting, such Sub-Committee to be composed as follows:—The Chairman of the Stock Prizes Committee (Mr. Sanday), the Hon. Cecil T. Parker, Sir Jacob Wilson, Mr. Crutchley (Hon. Director), Mr. R. M. Greaves, Mr. E. W. Stanyforth, Mr. R. Stratton, Mr. J. P. Terry, and Mr. C. W. Wilson, with power to add to their number.

#### Implement.

Mr. FRANKISH (Chairman) reported that the Committee had finally approved the Regulations for the Trial of Implements in connection with the Cardiff Meeting. They had decided that all exhibits in the Implement Department must be brought into the showyard by 5 P.M. on Saturday, June 22, and that the stands must be finally arranged, cleared up, and completed by 5 P.M. on Monday, June 24, 1901. The Committee had also approved the selection of Judges for the various classes of implements for which prizes would be offered at that meeting. The Committee had met eight times and had made eight reports during the year.

#### General Cardiff.

Sir WALTER GILBEY (Chairman) reported that they had discussed with the representatives of the Cardiff Local Committee, and had finally settled the schedule of local prizes for live stock, produce, &c., to be offered by the Cardiff Local Committee, and recommended their inclusion in the prize-sheet. The total amount of these local prizes was £712. The Committee recommended that the prices of admission to the Cardiff showyard should be fixed as follows:—

Wednesday, June 26, 1901, admission 5s.	
Thursday, " 27, " "	2s. 6d.
Friday, " 28, " "	2s. 6d.
Saturday, " 29, " "	1s.
Monday, July 1, " "	1s.

The representatives of the Cardiff Local Committee having expressed a wish to offer prizes for local butter-making competitions, the Committee recommended that the working dairy

should be continued for the Cardiff Meeting, and arrangements made for the butter-making competitions desired by the Local Committee.

#### Showyard Works.

Mr. CRUTCHLEY reported that the tender of Messrs. John Bland & Co., Ltd., of Cardiff, for the supply of timber for the Cardiff Meeting had been accepted. The Committee had considered the appointment of auctioneers for the sale of the timber after the Cardiff Meeting, and recommended that the offer of Messrs. Stephenson & Alexander, of Cardiff, to act in that capacity be accepted. The Committee had met eight times during the year and made eight reports.

#### Selection.

Sir JOHN THOROLD (Chairman) having read the recommendations of this Committee, formally moved: "That Mr. W. A. Prout, of Sawbridge-worth, Herts, be elected a member of the Council in the room of the Earl of Derby, appointed a Vice-President."

Sir WALTER GILBEY asked leave, as a friend and neighbour of Mr. Prout, to second the motion. He was of opinion that Mr. Prout, with his special agricultural experience, would prove a very useful member of their body.

The motion was carried unanimously; and on the motion of Sir JOHN THOROLD, seconded by Mr. CRUTCHLEY, Mr. R. M. Greaves was appointed a Steward of Implements, and Mr. E. W. Stanyforth a Steward of Stock for the Cardiff Meeting.

The Committee reported that they had further considered the question of the place of holding the Country Meeting of 1902, but had ultimately deferred the matter until the February meeting. During the year they had met eight times and made eight reports. They recommended that in accordance with the Standing Order passed by the Council on December 11, 1895, the Committee of Selection be constituted for the ensuing year of the President, the Chairman of each of the Standing Committees, Mr. Crutchley, Mr. Ransome, Mr. Wheeler, and the following three new members—the Earl of Derby, K.G.,

Mr. H. D. Marshall, and Mr. A. J. Smith—in the room of the late Mr. Rowlandson, and Sir Walter Gilbey and Mr. Ashworth, who retired by rotation.

#### **Education.**

Mr. DUGDALE reported that the Regulations and Syllabus for the Examinations of 1901 for the National Diploma in Agriculture and the National Diploma in Dairying, as settled by the National Agricultural Examination Board, were now in course of circulation. The Committee had met eight times and made eight reports during the year, and they moved for a grant of 400*l.* for the year 1901.

#### **Dairy.**

Mr. J. MARSHALL DUGDALE (Chairman) reported that the Committee had decided that the judging of the poultry and produce at the Cardiff Meeting should take place on Wednesday, June 26, and that the poultry should be sent to the showyard before 5 P.M. on Tuesday, June 25, and the produce by 5 P.M. on Monday, June 24. They had also finally settled the produce portion of the prize-sheet. The Committee had met eight times and made eight reports during the year.

#### **Special Show Committee.**

Sir NIGEL KINGSCOTE reported that since the decision of the Council on August 1, "That it is desirable to obtain a site in the neighbourhood of London for the purposes of the Society's permanent showyard," the Special Committee had been actively engaged in considering various sites offered to them in the London district, and had made a certain amount of progress in their inquiry, though they were not yet in a position to present any definite recommendation. It appeared probable that it would be necessary for the Society to rent, and, it might be hoped, eventually to acquire, a site of its own, capable of adaptation to the Society's special needs, and of being utilised—during the time it was not required for the preparations for the show and the show itself—for any other kindred or subsidiary purposes that might present them-

selves. The matter was so important for the future well-being of the Society that any proposals for the actual selection and equipment of a permanent showyard must be thoroughly well considered in all their bearings before a definite decision could be arrived at; and it was not, therefore, possible for the Special Committee on that occasion to do more than to report progress towards a solution of the difficult problem remitted to them.

#### **Standing Committees for 1901.**

The following Standing Committees were appointed for 1901:—Finance, House, Journal, Chemical and Woburn, Botanical and Zoological, Veterinary, Stock Prizes, Implement, Showyard Works, Selection, Education, Dairy.

The present members of the various Standing Committees were (with some exceptions) reappointed to those Committees. Sir Matthew Ridley, Bart., was added to the Finance Committee; Mr. R. M. Greaves to the Chemical and Stock Prizes Committees; Mr. Reynard to the Botanical Committee; Mr. A. C. Cope to the Veterinary Committee; Mr. R. Stratton to the Stock Prizes Committee; and Mr. Asheton to the Education Committee.

#### **Committee for Selection of Judges.**

On the motion of Mr. CRUTCHLEY, seconded by Sir NIGEL KINGSCOTE, a Committee was appointed to recommend judges of Stock, Poultry, and Produce at the Cardiff Meeting, such Committee to consist of the members of the Stock Prizes Committee and the Stewards of the several departments, and to sit for the first time in February next.

#### **Report to General Meeting.**

The Draft Report of the Council to the General Meeting of Governors and Members, to be held on the following day (Thursday), was considered and finally settled.

#### **Miscellaneous.**

Other business having been transacted, the Council adjourned over the Christmas recess until Wednesday, February 6, 1901.

## Proceedings at Half-yearly General Meeting of Governors and Members,

HELD AT THE SOCIETY'S HOUSE, 13 MANOVER SQUARE, LONDON, W.

THURSDAY, DECEMBER 13, 1900.

EARL CAWDOR (PRESIDENT) IN THE CHAIR.

Present :—

*Trustees.*—Sir Walter Gilbey, Bart., Sir John H. Thorold, Bart., Colonel Sir Nigel Kingsoote, K.C.B.

*Vice-Presidents.*—Lord Moreton, the Hon. Cecil T. Parker, Sir Jacob Wilson.

*Other Members of Council.*—Mr. J. H. Arkwright, Mr. Alfred Ashworth, Mr. B. C. Assheton, Mr. J. Bowen-Jones, Mr. Percy Crutchley, Lieut.-Colonel J. F. Curtis-Hayward, Mr. J. Marshall Dugdale, Mr. S. P. Foster, Mr. R. M. Greaves, Mr. Frederick Reynard, Mr. Howard P. Ryland, Mr. G. H. Sanday, Mr. E. W. Stanyforth, Mr. Martin J. Sutton, and Mr. J. P. Terry.

*Governor.*—Mr. W. F. Holt Beever.

*Members.*—The Right Hon. R. W. Hanbury, M.P., Sir Edmund Verney, Bart., Sir William Vincent, Bart., Professor Sir George Brown, C.B., Messrs. Arthur W. Arkwright, Arthur Bower, Leslie E. Clift, A. C. Cope, Henry Dudding, T. H. Elliott, C.B., C. L. Evans, G. H. Evans, S. W. Farmer, R. H. Gill, E. H. Godfrey, H. J. Greenwood, Surgeon-Lieut.-Colonel J. Ince, M.D., Messrs. Frederick King, Thomas May, Professor J. McFadyean, Lieut.-Colonel W. W. Maude, Messrs. R. Jasper More, M.P., J. J. Moubay, Professor J. Penberthy, Messrs. James Raymond, William Scooby, A. J. Stanton, C. L. Sutherland, S. T. Tregaskis, Edward Trimmen, T. P. Wilkes, A. O. Worthington, &c.

*Officers.*—Sir Ernest Clarke, Secretary; Dr. Fream, Editor of the Journal; Dr. J. Augustus Voelcker, Consulting Chemist; Mr. J. E. Compton-Bracebridge, Assistant Director; Mr. R. S. Burgess, Superintendent of the Showyard.

The SECRETARY having read the principal paragraphs of the Report of the Council for the past half-year (see page 694),

Sir WILLIAM VINCENT, Bart., in moving the adoption of the Report, said it was evident from the Report that the Council had been engaged, as in former years, in work covering every department of the agricultural interest. There was, indeed, no existing portion of that great industry which had not received the attention of the Council of the Society. They all deplored the serious losses of members which had occurred from deaths during the past half-year. These losses had been unusually severe, and when they looked through the list they would see the names of men who would be very much missed in various departments of public life, as well as in the important work of their Society. The Report dealt with one very weighty matter, viz. the location of their shows in the future. It was, no doubt, a very important departure which had been taken, and the reasons which had been assigned by the Council for the action which they had taken would, he felt convinced, commend themselves to the members present, and receive their sanction and support. He would again emphasise the fact that this

was a very important departure; yet he felt that the Council, under all the circumstances, were fully justified in the conclusion at which they had arrived to locate the Society's permanent showyard in the neighbourhood of London.

Mr. W. F. HOLT BREEVER said that he had much pleasure in seconding the motion for the adoption of the Report, and fully endorsed the remarks in the paragraph which recorded the appreciation of the Council of the valuable work performed by Dr. Fream as Editor of the Journal.

Surgeon-Lieut.-Colonel INCE, M.D., asked whether the attention of the Council had been called to the criticisms on the finances of the Society, which had recently appeared in the public press. He would have liked a little more authoritative information as to the financial position of the Society. The abandonment of the system of peregrination, and the decision to have the shows near London, were questions in which many members took a deep interest, although they must, he knew, trust their Council a long way—nearly to the end, in fact. But still there were questions which must be discussed. For instance, if they were to have their show in the neighbourhood of London, let them not, at any rate at present, buy the ground, but obtain it on hire, and not create a permanent burden upon the Society's resources. He certainly hoped that before a final decision was taken the subject would be more fully ventilated. With regard to the Journal, he noted that a decision had been come to to issue it in future in an annual volume instead of in quarterly parts. The reasons which had induced this decision were no doubt very excellent. But he could not help bearing in mind that, in connection with the Royal Horticultural Society, they had found, in the last few years, that by the revival of the publication of the Reports and Journals of the Society they had increased by a hundredfold the interest in the Society. He thought that this also was a point which should be further considered before an annual volume was decided upon.

The PRESIDENT said that, as explained in paragraph 9 of the Report, a complete statement of accounts for 1900 could not be presented until the completion of the calendar year; but their financial position was foreshadowed in the paragraphs relating to the results of the York Meeting. As to the question of the site for a permanent showyard, he might refer the Member to paragraph 14 of the Report, where the following sentence occurred:—"It appears probable that it will be necessary for the Society to rent, and it may be hoped eventually to acquire, a site of its own, capable of adaptation to the Society's special needs." The Society's permanent showyard would move on the lines suggested, and not necessarily be located upon a site which they must buy. With regard to the question of the Journal, the change had been made in deference to a widely-expressed desire for an annual volume instead of a quarterly one, as hitherto.

No other Member rising,

The PRESIDENT put the motion for the adoption of the Report, which was carried unanimously.

#### **Vote of Thanks to Auditors.**

Mr. R. JASPER MORE, M.P., in moving a vote of thanks to the retiring Auditors, Messrs. A. H. Johnson, Henry Grinling, and Jonas M. Webb, said he was sure it would be a satisfaction to the gentleman who had just spoken on the subject of the Society's finances to know that the accounts were well audited, and that the Society's interests would be well safeguarded by the re-election of these three gentlemen to the responsible office which they had held with credit to themselves and benefit to the Society during the past year. He begged, therefore, formally to move "That the best thanks of the Society are due, and are hereby tendered, to Messrs. A. H. Johnson, Henry Grinling, and Jonas M. Webb for their services as Auditors during the past year, and that they be re-elected Auditors for the ensuing year."

Mr. ARTHUR BOWER seconded the motion, which was carried unanimously.

**Vote of Thanks to the Chairman.**

The **PRESIDENT** put the usual inquiry from the Chair as to whether any Governor or Member had any question to ask or suggestion to offer that might be referred to the Council for their consideration; but as no Governor or Member rose in response to this invitation,

The **Right Hon. R. W. HANBURY, M.P.**, President of the Board of Agriculture, said that he had the pleasure of proposing the next resolution, which was a vote of thanks to their Chairman. It did not require many words at his hands to commend to them their Chairman, who occupied the principal position in the Society, and therefore he could not do more than to say that Lord Cawdor presided over a Society which, as Sir William Vincent had pointed out, dealt with every branch of agriculture, and at the same time watched over agriculture as a whole. He must say that so far as his short experience at the Board of Agriculture went, he wished the Board of Agriculture covered as wide a field as the Royal Agricultural Society. No doubt, however, the Board would develop as time went on. He would certainly do his best to assist the work of that admirable Society in promoting the welfare of agriculture generally. With regard to their Chairman, it was not difficult to preside over a meeting such as that now being held, but his skill as a Chairman was more fully taxed in the other office which Lord Cawdor held with much distinction, viz. the Chairmanship of the Great Western Railway. Whether as President of the Royal Agricultural Society or as Chairman of a large Railway Company, he had no doubt that Lord Cawdor would do his best for the cause of agriculture.

**Mr. HENRY DUDDING** said he had much pleasure in seconding the vote of thanks. The Society was fortunate in possessing a most able man as their President, and he felt quite certain that under his guidance the Society would meet with prosperity.

The motion was then put to the meeting by the **SECRETARY**, and carried unanimously.

The **PRESIDENT**, in expressing his acknowledgments for the vote of thanks, said he felt it a great honour to occupy the position of their President, for he took great interest in the work of the Society and in the conduct of its business affairs. There were undoubtedly many difficult questions which they were endeavouring to solve at the present moment, and it was a great source of satisfaction that the Members had shown, as they had done that day, ungrudging confidence in the Council of the Society. Personally he did not think anything could be more satisfactory. With reference to what had fallen from Mr. Hanbury as to his relations with a railway company, he would always be most willing, so far as he was able, to promote the welfare of the agricultural industry. He was sure the Members would desire to tender their thanks to Mr. Hanbury for his kindness in coming there that day. They all recognised that the Board of Agriculture had at its head a very capable business man, who, he did not doubt, would be glad to keep in touch with other agricultural bodies, and he thought that the agricultural industry could not be in stronger or safer hands than in those of the present chief of the Board of Agriculture.

The proceedings then terminated.

Notice is hereby given that the **Sixty-Second Anniversary Meeting of Governors and Members of the Royal Agricultural Society of England** will, in accordance with Clause 6 of the Charter, be held at the Society's House, 13, Hanover Square, London, on **Wednesday, May 22, 1901, at Noon**, when the **Half-yearly Report of the Council** will be read, and the **Election of the President, Trustees, and Vice-Presidents**, and of **Twenty-five Members of Council** will take place.

**ERNEST CLARKE**, *Secretary*

13, Hanover Square, London, W  
December, 1900.

## STATEMENT OF RECEIPTS AND EXPEN.

Corresponding figures for 1899

## Receipts.

£2,000

## SUBSCRIPTION:-

From York Local Committee . . . . .

£ s. d.

£ s. d.

2,000 0 0

## FEES FOR ENTRY OF IMPLEMENTS:-

4,271	Implement Exhibitors' Payments for Shedding . . . . .	5,074 11 0	
183	Non-Members' Fees for Entry of Implements . . . . .	181 0 0	
52	Fees for Entry of "New Implements". . . . .	53 0 0	
4,506			5,308 11 0

## FEES FOR ENTRY OF LIVE STOCK:-

768	By Members:-1,379 Entries @ 10s. . . . .	689 10 0	
—	13 " @ 2s. 6d. . . . .	1 12 6	
68	122 Post Entries @ 15s. . . . .	91 10 0	
57	64 Late " @ 1l. . . . .	64 0 0	
10	30 Substituted Entries @ 5s. . . . .	7 10 0	
182	By Non-Members:-320 Entries @ 1l. . . . .	320 0 0	
—	20 " @ 5s. . . . .	5 0 0	
25	52 Post Entries @ 30s. . . . .	78 0 0	
24	23 Late " @ 2l. . . . .	44 0 0	
3	5 Substituted Entries @ 10s. . . . .	2 10 0	
512	Fees for Horse Boxes and Stalls . . . . .	773 10 0	
1,648			2,077 2 6

## FEES FOR ENTRY OF POULTRY:-

17	By Members:-154 Entries @ 2s. 6d. . . . .	19 5 0	
3	6 Post Entries @ 5s. . . . .	1 10 0	
114	By Non-members:-414 Entries @ 5s. . . . .	103 10 0	
8	17 Post Entries @ 10s. . . . .	8 10 0	
145	Entries of Table Poultry . . . . .	2 8 0	125 3 0

## OTHER ENTRY FEES:-

79	Fees for Entry of Produce . . . . .	84 10 0	
15	Fees for Entries in Horse-shoeing Competition . . . . .	16 5 0	
—	Deposit in Competition Forfeited . . . . .	5 0 0	

## CATALOGUE:-

26	Extra Lines for particulars of Implement Exhibits . . . . .	19 13 0	
9	Woodcuts of New Implements . . . . .	6 3	
105	Advertisements in Catalogue . . . . .	173 9 5	
230			201 8 8
34 {	Sales of Implement Section of Catalogue (including bound copies). . . . .	24 8 9	
303	Sales of Combined Catalogue . . . . .	599 6 6	
23	" " " (bound copies) @ 2s. 6d. . . . .	16 10 0	
11	Catalogues sold after Show, &c. . . . .	4 12 3	
371		684 17 6	
43	Less Commission on Sales in Showyard . . . . .	56 3 0	
328			598 14 6

## MISCELLANEOUS RECEIPTS:-

138	Fines for Non-Exhibition of Live Stock, &c. . . . .	116 0 0	
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£9,091

Carried forward . . . . .

£10,542 14 8

# DITURE AT THE YORK MEETING, 1900.

ccxi

Corresponding figures for 1899

## Expenditure.

		£	s.	d.	£	s.	d.
<b>COST OF ERECTION OF SHOWYARD:—</b>							
£6,077	Timber . . . . .	7,262	18	1			
108	Ironmongery . . . . .	118	18	9			
68	Paints, Oil, Glass, Lead, &c. . . . .	63	11	2			
48	Bricks, Lime, Cement, and Coal . . . . .	43	9	3			
1,067	Hire of Canvas . . . . .	1,265	14	7			
226	Roofing Cloth, Felt, &c. . . . .	290	10	5			
968	Railway Charges, 831 <i>l.</i> 1 <i>s.</i> ; Horse Hire, 130 <i>l.</i> 1 <i>s.</i> 3 <i>d.</i> . . . . .	963	5	2			
46	Insurance . . . . .	40	14	1			
67	Stationery, Postage, and Telegrams . . . . .	66	1	11			
2	Hire of Furniture, &c. . . . .	3	18	3			
3,202	Wages . . . . .	3,247	3	0			
655	Superintendent's Salary and Expenses . . . . .	486	9	5			
<b>COST OF WATER PIPES:—</b>							
138 {	Proportion of original cost of Water Pipes, &c. (368 <i>l.</i> 1 <i>s.</i> 3 <i>d.</i> ), debited to York Meeting . . . . .	108	12	10			
315 {	Cost of Labour and Superintendence in laying down and taking up Pipes . . . . .	358	5	0			
13,048		12,897	9	11			
<b>Less:—</b>							
3,652	Sale of Materials . . . . .	£4,200	11	1			
1,489	Work for Exhibitors and Purveyors . . . . .	1,437	14	11			
		5,638	6	0			
5,141					8,269	3	11
7,907	<b>EXPENSES AT HEAD OFFICE IN LONDON:—</b>						
45	Expenses of Inspection Committee . . . . .	19	10	3			
1,071 {	Assistant Director's Salary and Proportion of Salaries of Ordinary Clerical Staff debited to Show Account . . . . .	1,044	5	0			
13	Assistant Director's Journeys to York and Expenses . . . . .	16	17	3			
74	Extra Clerical Assistance . . . . .	247	0	4			
1,203					1,327	12	10
<b>PRINTING:—</b>							
449 {	Printing of Prize Sheets, Certificates, Admission Orders, Parchment Numbers, Circulars to Exhibitors, Prize Cards, Members' Tickets, and Miscellaneous . . . . .	356	17	2			
1	Secretary's Local Printing . . . . .	5	3	2			
50	Programmes for Members . . . . .	52	14	7			
37	Plans of Showyard . . . . .	38	4	0			
525	Printing of Catalogues . . . . .	628	7	5			
37	Binding of Catalogues . . . . .	63	2	0			
14	Carriage of Catalogues to Showyard . . . . .	25	13	10			
61	Printing Awards . . . . .	47	4	0			
1,174					1,316	6	2
<b>ADVERTISING, BILL POSTING, AND PLACARDING:—</b>							
709 {	Advertising Closing of Entries in Newspapers . . . . .	88	13	3			
	Advertising Show in Newspapers . . . . .	160	13	5			
	Contract for Bill Posting and Placarding . . . . .	440	0	0			
	Printing of Posters and Placards . . . . .	271	5	0			
					950	11	8
<b>POSTAGE, CARRIAGE, &amp;C.:—</b>							
125 {	General Postage, &c., 88 <i>l.</i> 2 <i>s.</i> 10 <i>d.</i> ; Postage of Tickets to Members, 40 <i>l.</i> 17 <i>s.</i> 8 <i>d.</i> ; Carriage, 13 <i>l.</i> 7 <i>s.</i> 7 <i>d.</i> . . . . .				143	9	1
4,791	<b>AMOUNT OF PRIZES AWARDED (for details see page ccxii).</b> . . . .				4,495	13	6
<b>COST OF FORAGE FOR LIVE STOCK:—</b>							
674 {	Hay, 224 <i>l.</i> 6 <i>s.</i> 4 <i>d.</i> ; Straw, 363 <i>l.</i> 1 <i>s.</i> 4 <i>d.</i> ; Green Food, 132 <i>l.</i> 6 <i>s.</i> 6 <i>d.</i> ; Miscellaneous Expenses, 3 <i>l.</i> 17 <i>s.</i> 0 <i>d.</i> . . . . .				724	3	2
£16,585							

Corresponding  
figures for  
1899

## Receipts (contd.)

£ s. d. £ s. d.

£9,091	Brought forward . . . . .		10,542	14	8
25	Amounts received from Refreshment Contractors . . . . .		25	0	0
53	Premium for Cloak Room, &c. . . . .		52	10	0

## ADMISSIONS TO SHOWYARD:—

22	Saturday, June 16, @ 2s. 6d. . . . .	19	12	6	
263	Monday, June 18, @ 5s. . . . .	558	4	11	
1,118	Tuesday, June 19, @ 2s. 6d. . . . .	1,348	11	6	
1,064	Wednesday, June 20, @ 2s. 6d. . . . .	1,503	14	0	
1,629	Thursday, June 21, @ 1s. . . . .	2,530	16	4	
639	Friday, June 22, @ 1s. . . . .	442	8	8	
205	Day Tickets . . . . .	77	11	0	
97	Season Tickets . . . . .	112	6	6	
5,037			8,594	5	5

## ENTRANCES TO HORSE RING:—

25	Monday, June 18 . . . . .	79	18	0	
214	Tuesday, June 19 . . . . .	338	16	0	
101	Wednesday, June 20 . . . . .	151	3	0	
113	Thursday, June 21 . . . . .	215	12	0	
22	Friday, June 22 . . . . .	15	15	0	
475			801	4	

## DAIRY:—

10	Receipts at Stand at Dairy . . . . .	13	7	0	
56	Sales of Produce at Dairy . . . . .	53	17	8	
66			67	4	

## PRIZES AWARDED:—

		£	s.	d.	
3,418	Horses, 2,402l.; Cattle, 1,735l. . . . .	4,127	0	0	
1,730	Sheep . . . . .	1,406	0	0	
245	Poultry . . . . .	246	5	0	
184	Cheese, 130l.; Butter, 59l. . . . .	189	0	0	
40	Older and Perry . . . . .	40	0	0	
210	Horse-shoeing . . . . .	32	0	0	
18	Implements . . . . .	130	0	0	
82	Silver Medals for New Implements . . . . .	5	8	6	
100	Contribution to Bee Department . . . . .	40	0	0	
6					
40					
6,018		6,215	13	6	
	Less:—				
1,110	Prizes given by Local Committee . . . . .	£1,534	0		
117	" " Various Societies . . . . .	186	0		
1,227		1,720	0	0	
4,791		£4,495	13	6	
6,382	Balance to Debit of York Meeting . . . . .		2,461	17	8
£21,133			£21,547	16	2

ERNEST CLARK, Secretary.

WELTON, JONES &amp; CO., Accountants.

## EXPENDITURE AT THE YORK MEETING, 1900 (continued).

ccxiii

Correspond-  
a figures for  
1899

## Expenditure (contd.)

16,585

Brought forward . . . . .

£ s. d. £ s. d.  
17,116 0 4

## JUDGES' FEES AND EXPENSES:—

892

Judges of Miscellaneous Implements, 25l. 11s. 0d.; Ditto for  
Lodgings, 11l. . . . .  
Judges of Cultivators and Steam Diggers . . . . .  
Judges of Milking Machines . . . . .  
Judges of Sheep-shearing Machines . . . . .  
Judges of Horses, 189l. 4s. 1d.; Cattle, 226l. 13s. 2d.; Sheep,  
241l. 4s. 11d.; Poultry, 37l. 15s. 9d.; Butter, 16l. 19s.; Cheese,  
15l. 15s. 3d.; Older and Perry, 18l. 16s. 7d.; Horse-shoeing,  
17l. 8s. 10d.; Ditto for Lodgings, 11l. 10s. . . . .

36 11 0  
61 3 6  
6 6 0  
8 6 6  
742 2 7

844 9 7  
26 12 0  
38 5 6

39  
30

Badges for Judges and other Officials . . . . .  
Rosettes . . . . .

## EXPENSES OF ADMINISTRATION:—

275

*Stewards*:—Housekeeping Expenses, 181l. 17s.; Personal and  
Railway Expenses, 48l. 6s. 7d. . . . .

230 3 7

174

*Assistant Stewards*:—Honoraria, 89l.; Railway Expenses,  
19l. 18s. 10d.; Lodgings, 57l. 15s. . . . .

160 13 10

99

*Official Staff*:—Houses, 41l.; Maintenance of Clerks, 55l.;  
Travelling Expenses, &c., 19l. 9s. 1d.; Secretary's Personal  
Expenses, 3l. 8s. . . . .

118 17 1

91

*Finance Office*:—Superintendent of Turnstiles, 20l. 2s.; Money  
Takers, 62l. 8s. 6d.; Bank Clerks, 19l. 5s. . . . .

101 16 6

48

*Awards Office*:—Clerks, 23l. 2s.; Award Boys, 12l. 8s. 4d. . . . .

35 10 4

687

*General Management*:—

177

Foreman and Assistant Foremen . . . . .

124 6 2

383

Yardmen, Grooms, and Foddermen . . . . .

408 8 5

74

Door and Gate Keepers . . . . .

80 16 9

214

Carriage Hire, 20l. 14s.; Horse Hire, 62l. 7s. 9d. . . . .

153 1 9

848

76 13 1

138

*Veterinary Department*:—Veterinary Inspectors, 164l. 1s. 6d.;  
Lodgings, 5l. 15s.; Hire of Stables for Sick Horses, 4l. . . . .

163 16 6

287

*Engineering Department*:—Consulting Engineer and Assist-  
ants, 198l. 19s. 8d.; Carriage, 16l. 16s.; Repairs and Mainte-  
nance of Machinery, 80l. 11s. 6d.; Wages to Workmen, 14l. 19s. 4d. . . . .

281 6 6

637

*Police, &c.*:—Metropolitan Police, 682l. 1s. 4d.; Commissionaires,  
58l. 2s. 6d. . . . .

738 10 10

1,062

14

*Dairy*:—Milk, 35l. 1s. 1d.; Ice, 37l. 10s.; Dairy Staff, 121l. 17s. 6d.;  
Salt, 1l. 7s.; Utensils, 72l. 6s. 5d.; Coal, 3l. 4s. 7d.; Carriage,  
2s. 4d. . . . .

1,183 13 10

304

*Poultry*:—Penning, Attendants and Food, 18l. 14s. 6d.; Poultry  
Killing, 1l. 15s. 8d.; Purchase of Dead Poultry, 2l. 5s. 9d. . . . .

261 9 11

62

Carriage of Poultry to and from Showyard, 9l. 4s. 6d. . . . .

29 0 5

32

*Horse-shoeing*:—Hire of Forges, 18l. 6s. 7d.; Coal, 2l. 8s. 7d.;  
Ironmongery, 2l. 12s. 6d.; Wages and Gratuities, 4l. 10s. 7d. . . . .

27 18 3

## GENERAL SHOWYARD EXPENSES:—

112

*Military Band* . . . . .

105 0 0

50

*St. John Ambulance Association* . . . . .

50 0 0

88

*Royal and Official Luncheons* . . . . .

48 10 6

12

*Gratuities to Bath Chairmen* . . . . .

16 0 0

228

*Hire*:—Furniture, Canvas, &c., 49l. 18s. 2d.; Chairs, 40l. 11s. 6d.;  
Tumbler Carts, 35l. . . . .

115 4 8

*Miscellaneous*:—Tan, 11l. 10s. 4d.; Telegraph Extension, &c.,  
19l. 14s. 6d.; Newspapers, 1l. 7s. 11d.; Ironmongery, 1l. 15s. 2d.;  
Coal, 3l. 14s. 1d.; Carriage and Cartage, 21l. 8s. 11d.; Cutting  
Grass, 13l. 15s.; Net Expenses of Zebra Hybrid Exhibits,  
7l. 19s. 8d.; Floral Decorations, 12l. 12s.; Various Payments  
by Secretary, 8l. 12s. 3d.; Ditto by Superintendent, 20l. 8s. 11d. . . . .

122 18 9

45

582

457 13 11

6

EXPENSES OF IMPLEMENT TRIALS . . . . .

132 19 0

£21,133

Total Expenditure . . . . .

£21,547 16 2

Examined, audited, and found correct, this 3rd day of December, 1900.

A. H. JOHNSON  
HENRY GRINLING } Auditors on behalf of the Society.  
JONAS M. WEBB

## PRIZE LIST

FOR

CARDIFF MEETING, JUNE 26 to JULY 1, 1901.

Total value of Prizes offered (exclusive of Champion Prizes and Medals offered by Breed Societies), £5,889: of which amount £712 are contributed by the Cardiff Local Committee, and £353 by various Breed Societies.

## CHAMPION PRIZES.

The following Champion Prizes are offered by various Breed Societies, &c. :

- |                                                       |                                                                                                                                                                                                                 |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Hunters' Improvement Society</i> . . .             | GOLD MEDAL, value £10 10s., for the best Hunter Filly not exceeding 8 years old.                                                                                                                                |
| <i>Hackney Horse Society</i> . . .                    | TWO GOLD MEDALS for the best Hackney Stallion, and for the best Mare or Filly.                                                                                                                                  |
| <i>Polo Pony Society</i> . . .                        | SILVER MEDAL for the best Welsh Pony.                                                                                                                                                                           |
| <i>Polo Pony Society</i> . . .                        | TWO GOLD MEDALS for the best Polo Pony Stallion, and for the best Mare.                                                                                                                                         |
| <i>Shire Horse Society</i> . . .                      | TWO GOLD MEDALS for the best Shire Stallion, and for the best Mare or Filly.                                                                                                                                    |
| <i>Shorthorn Society</i> . . .                        | TWO PRIZES of £20 each for the best Short-horn Bull, and for the best Cow or Heifer.                                                                                                                            |
| <i>Hereford Cattle Breeders' Association.</i>         | TWO PRIZES of £10 10s. each for the best Hereford Bull, and for the best Cow or Heifer.                                                                                                                         |
| <i>Devon Cattle Breeders' Association.</i>            | TWO PRIZES of £10 10s. each for the best Devon Bull, and for the best Cow or Heifer.                                                                                                                            |
| <i>North Wales Black Cattle Society</i> .             | TWO FIVE-GUINEA SILVER CUPS for the best Welsh Bull, and for the best Cow or Heifer.                                                                                                                            |
| <i>Red Polled Cattle Society</i> . . .                | TWO PRIZES of £10 each for the best Red Polled Bull, and for the best Cow or Heifer.                                                                                                                            |
| <i>Polled Cattle Society</i> . . .                    | GOLD MEDAL for the best Aberdeen Angus Bull, Cow, or Heifer.                                                                                                                                                    |
| <i>Kerry and Dexter Cattle Society</i> .              | TWO CHALLENGE CUPS, value £26 5s. each, for the best Kerry Bull, Cow, or Heifer, and for the best Dexter Bull, Cow, or Heifer. The Cup to be the property of an Exhibitor winning it three years in succession. |
| <i>Southdown Sheep Society</i> . . .                  | PRIZE of £10 10s. for best Southdown Ram.                                                                                                                                                                       |
| <i>Suffolk Sheep Society</i> . . .                    | GOLD MEDAL for best Suffolk Ram.                                                                                                                                                                                |
| <i>Lincoln Long-wool Sheep Breeders' Association.</i> | PRIZE of £10 10s. for the best Lincoln Ram.                                                                                                                                                                     |
| <i>National Pig Breeders' Association</i> .           | FOUR GOLD MEDALS, value £3 5s. each, for the best Boar or Sow of the Large White, Middle White, Small White, and Tamworth breeds.                                                                               |
| <i>British Berkshire Society</i> . . .                | PRIZE of £5 for the best Berkshire Boar or Sow.                                                                                                                                                                 |

**HORSES (£1,695).**

Class	HUNTERS.	Prizes		
		1st £	2nd £	3rd £
1	MARE, with foal at foot (15 st. and upwards)	20	10	5
2	MARE, with foal at foot (12 to 15 st.)	20	10	5
3	MARE OR GELDING (up to 15 st.), foaled in '95 or '96 <sup>1</sup>	25	10	5
4	MARE OR GELDING (up to 12 st.), foaled in '95 or '96 <sup>1</sup>	20	10	5
5	MARE OR GELDING, foaled in 1897 <sup>1</sup>	20	10	5
6	GELDING, foaled in 1898 <sup>1</sup>	15	10	5
7	FILLY, foaled in 1898	15	10	5
8	FILLY, foaled in 1899	15	10	5
9	FILLY, foaled in 1900	10	5	-

**CLEVELAND BAYS AND COACH HORSES.**

10	STALLION, foaled in 1898	15	10	5
11	STALLION, foaled in 1899	15	10	5
12	MARE (with foal at foot)	15	10	5

**HACKNEYS.**

13	STALLION, foaled in 1898, 15 hds. 1 in. and upwards	15	10	5
14	STALLION, foaled in 1897 or 1898, above 14 hands and under 15 hands 1 inch <sup>1</sup>	15	10	5
15	STALLION, foaled in 1899	15	10	5
16	STALLION, foaled in 1900	15	10	5
17	MARE (with foal at foot), 15 hands and upwards	15	10	5
18	MARE (with foal at foot), above 14 and under 15 hands <sup>1</sup>	15	10	5
19	FILLY, foaled in 1898	15	10	5
20	FILLY, foaled in 1899	15	10	5
21	MARE OR GELDING, foaled in 1895, 1896, or 1897, to carry 15 st. and upwards <sup>1</sup>	15	10	5
22	MARE OR GELDING, foaled in '95, '96, or '97, to carry 12 st. and under 15 st. <sup>1</sup>	15	10	5

**PONIES.**

23	STALLION, not over 14 hds.	15	10	5
24	MARE (with foal at foot), not over 14 hands	15	10	5
25	MARE OR GELDING, 13 hands 2 inches, and not above 14 hands 2 inches <sup>1</sup>	10	5	8
26	MARE OR GELDING, under 13 hands 2 inches <sup>1</sup>	10	5	8

**SHETLAND PONIES.**

27	STALLION, foaled before or in 1898, not over 10½ hds. <sup>2</sup>	5	8	2
28	MARE, foaled before or in 1898, not over 10½ hds. <sup>2</sup>	5	8	2

<sup>1</sup> Offered by the Cardiff Local Committee.<sup>2</sup> Offered by the Shetland Pony Stud Book Society.<sup>3</sup> These Prizes are contributed by the Polo Pony Society (£94) and the Cardiff Local Committee (£86).

Class	MOUNTAIN AND MOORLAND PONIES.	Prizes		
		1st £	2nd £	3rd £

29	STALLION, foaled before or in 1898, not over 13 h. 2 in.	10	5	-
30	MARE, foaled before or in 1898, not over 13 h. 2 in.	10	5	-

**WELSH MOUNTAIN PONIES.**

31	STALLION, foaled before or in 1898, not over 13 hds. <sup>1</sup>	10	5	-
32	MARE, foaled before or in 1898, not over 13 hands <sup>1</sup>	10	5	-

**POLO PONIES.<sup>3</sup>**

33	STALLION, not exceeding 14 hands 2 inches	15	10	5
34	STALLION (Eastern Sire) not over 14 hands 2 inches	10	7	8
35	MARE, above 13-2 and not over 14-2 hds., with foal at foot, or to foal in 1901	10	7	8
36	MARE, not over 13-2 hands, with foal at foot, or to foal in 1901	10	7	8
37	COLT, GELDING, OR FILLY, foaled in 1898, not over 14 hands 1 inch	7	4	2
38	COLT, GELDING, OR FILLY, foaled in 1899, not over 14 hands	7	4	2
39	COLT, GELDING, OR FILLY, foaled in 1900	7	4	2

**HARNESS HORSES AND PONIES.***To be driven in Single Harness.*

40	MARE OR GELDING, any age, above 15 hands 2 in. <sup>1</sup>	15	10	5
41	MARE OR GELDING, any age, above 15 hands and not over 15 hands 2 in. <sup>1</sup>	15	10	5
42	MARE OR GELDING, any age, above 14 and not over 15 hands <sup>1</sup>	15	10	5
43	PONY MARE OR GELDING, any age, not over 14 h. <sup>1</sup>	15	10	5

**SHIRE.**

44	STALLION, foaled in 1898	20	10	5
45	STALLION, foaled in 1899	20	10	5
46	STALLION, foaled in 1900	15	10	5
47	MARE (with foal at foot)	20	10	5
48	FILLY, foaled in 1898	15	10	5
49	FILLY, foaled in 1899	15	10	5
50	FILLY, foaled in 1900	15	10	5

**CLYDESDALE.**

51	STALLION, foaled in 1898	15	10	5
52	STALLION, foaled in 1899	15	10	5
53	MARE (with foal at foot)	15	10	5
54	FILLY, foaled in 1898	15	10	5

**SUFFOLK.**

55-58 Same as for Clydesdale.

Class	COLLIERY HORSES.	Prizes		
		1st £	2nd £	3rd £
59	MARE OR GELDING, over 14 hds. 2 in. and not over 15 hds. 2 in., suitable for underground work <sup>1</sup>	10	5	3
60	MARE OR GELDING, not over 14 hds. 2 in., suitable for underground work <sup>1</sup>	10	5	3

### DRAUGHT HORSES OF ANY BREED.

(To be shown in Harness, on June 29 only).

61	CART GELDING, foaled in 1897 <sup>1</sup>	10	5	3
62	CART GELDING, foaled in 1898 <sup>1</sup>	10	5	3
63	HORSE, MARE OR GELDING, suitable for a Builder, Braver, Timber Merchant, Tradesman, Haulier, Railway, or Corporation <sup>1</sup>	10	5	3

Entries close May 15. Entry Fees—Members, 2s. 6d., Non-Members, 6s.

## CATTLE (£1,778).

### SHORTHORN.

64	BULL, calved in '97 or '98	15	10	5
65	BULL, calved in 1899	15	10	5
66	BULL, calved in 1900	15	10	5
67	Cow, in-milk, calved in '95, '96, or '97	15	10	5
68	HEIFER, in-milk, calved in 1898	15	10	5
69	HEIFER, calved in 1899	15	10	5
70	HEIFER, calved in 1900	15	10	5

### LINCOLNSHIRE RED SHORTHORN.

71	BULL, calved in '97, '98, or 1899 <sup>2</sup>	15	10	-
72	BULL, calved in 1900 <sup>2</sup>	10	5	-
73	Cow, in-milk, calved in '95, '96, '97, or '98 <sup>2</sup>	15	10	-
74	HEIFER, calved in 1899 or 1900 <sup>2</sup>	10	5	-

### HEREFORD.

75	BULL, calved in '97 or '98	15	10	5
76	BULL, calved in 1899	15	10	5
77	BULL, calved in 1900	15	10	5
78	Cow, in-milk, calved in '95, '96, or '97	10	5	-
79	HEIFER, in-milk, calved in 1898	10	5	-
80	HEIFER, calved in 1899	15	10	5
81	HEIFER, calved in 1900	15	10	5

<sup>1</sup> Offered by the Cardiff Local Committee.

<sup>2</sup> The prizes in classes 71 to 74 are offered by the Lincolnshire Red Short-horn Association.

Class	DEVON.	Prizes		
		1st £	2nd £	3rd £
82	BULL, calved in 1897, 1898, or 1899	15	10	5
83	BULL, calved in 1900	15	10	5
84	Cow, in-milk, calved in '95, '96, or '97	15	10	5
85	HEIFER, in-milk, calved in 1898	15	10	5
86	HEIFER, calved in 1899	10	5	-
87	HEIFER, calved in 1900	10	5	-

### SUSSEX.

88	BULL, calved in 1897, 1898, or 1899	15	10	5
89	BULL, calved in 1900	15	10	5
90	Cow or HEIFER, in-milk, calved in '95, '96, '97, or '98	15	10	5
91	HEIFER, calved in 1899	10	5	-
92	HEIFER, calved in 1900	10	5	-

### LONGHORN.

93	BULL, calved in '97 or '98	10	5	-
94	Cow or HEIFER, in-milk, calved in '95, '96, '97, or '98	10	5	-

### WELSH.

95-101 Same as for Hereford.

### RED POLLED.

102-106 Same as for Sussex.

### ABERDEEN ANGUS.

107	BULL, calved in 1897, 1898, or 1899	15	10	5
108	BULL, calved in 1900	15	10	5
109	Cow or HEIFER, in-milk, calved in '95, '96, '97, or '98	15	10	5
110	HEIFER, calved in 1899	10	5	-

### GALLOWAY.

111-114 Same as for Aberdeen Angus.

### HIGHLAND.

115	BULL, any age	15	10	5
116	Cow or HEIFER, in-milk	15	10	5

### AYRSHIRE.

117 & 118 Same as for Highland.

### JERSEY.

119	BULL, calved in 1897, 1898, or 1899	15	10	5
120	BULL, calved in 1900	10	5	-
121	Cow, in-milk, calved in 1895, 1896, 1897, or 1898	15	10	5
122	HEIFER, in-milk, calved in 1899	15	10	5
123	HEIFER, calved in 1900	15	10	5

### GUERNSEY.

124	BULL, calved in 1897, 1898, or 1899	15	10	5
125	BULL, calved in 1900	10	5	-
126	Cow or HEIFER, in-milk, calved in '95, '96, '97, or '98	15	10	5
127	HEIFER, calved in 1899	10	5	-
128	HEIFER, calved in 1900	10	5	-

Class	KERRY.	Prizes		
		1st	2nd	3rd
		£	£	£
129	BULL, calved in 1897, 1898, 1899, or 1900 . . .	10	5	18
180	COW or HEIFER, in-milk, calved in 1895, 1896, 1897, or 1898 . . .	10	5	18
181	HEIFER, calved in 1899 or 1900 <sup>1</sup> . . .	10	5	8

**DEXTER.**

182-184 Same as for Kerry.

**DAIRY COWS.**

185 Cow, in-milk, of any breed or cross . . . 15 10 5

**SHEEP (£1,332 10s.).**

**OXFORD DOWN.**

136	TWO-SHEAR RAM . . .	10	5	-
137	SHEARLING RAM . . .	15	10	5
138	THREE RAM LAMBS, dropped in 1901 . . .	10	5	-
139	THREE SHEARLING EWES . . .	15	10	5
140	THREE EWE LAMBS, dropped in 1901 . . .	10	5	-

**SHROPSHIRE.**

141	TWO-SHEAR RAM . . .	10	5	-
142	SHEARLING RAM . . .	15	10	5
143	FIVE SHEARLING RAMS <sup>2</sup> . . .	15	10	5
144	THREE RAM LAMBS, dropped in 1901 . . .	10	5	-
145	THREE SHEARLING EWES . . .	15	10	5
146	THREE EWE LAMBS, dropped in 1901 . . .	10	5	-

**SOUTHDOWN.**

147-151 Same as for Oxford Down.

**HAMPSHIRE DOWN.**

152-156 Same as for Oxford Down.

**SUFFOLK.**

157-161 Same as for Oxford Down.

**SOMERSET AND DORSET HORN.**

162	SHEARLING RAM, dropped after November 1, 1899 . . .	10	5	-
163	THREE SHEARLING EWES, dropped after Nov. 1, '99 . . .	10	5	-

**LINCOLN.**

164	TWO-SHEAR RAM . . .	10	5	-
165	SHEARLING RAM . . .	15	10	5
166	FIVE SHEARLING RAMS <sup>3</sup> . . .	15	10	5
167	THREE RAM LAMBS, dropped in 1901 . . .	10	5	-
168	THREE SHEARLING EWES . . .	15	10	5
169	THREE EWE LAMBS, dropped in 1901 . . .	10	5	-

<sup>1</sup> Offered by the English Kerry and Dexter Cattle Society.

<sup>2</sup> Offered by the Shropshire Sheep Breeders' Association, together with a 4th Prize of £2 10s. in this Class (143).

<sup>3</sup> Offered by the Lincoln Long-wool Sheep Breeders' Association.

<sup>4</sup> Offered by the Devon Long-woolled Sheep Breeders' Society.

<sup>5</sup> Offered by the Cardiff Local Committee.

Class	LEICESTER.	Prizes		
		1st	2nd	3rd
		£	£	£
170	SHEARLING RAM . . .	15	10	5
171	THREE RAM LAMBS, dropped in 1901 . . .	10	5	-
172	THREE SHEARLING EWES . . .	15	10	5
173	THREE EWE LAMBS, dropped in 1901 . . .	10	5	-

**COTSWOLD.**

174-177 Same as for Leicester.

**BORDER LEICESTER.**

178-181 Same as for Leicester.

**KENTISH OR ROMNEY MARSH.**

182	SHEARLING RAM . . .	10	5	-
183	THREE SHEARLING EWES . . .	10	5	-

**WENSLEYDALE.**

184 & 185 Same as for Kentish or Romney Marsh.

**DEVON LONG-WOOLLED.**

186	SHEARLING RAM . . .	10	5	-
187	THREE RAM LAMBS, dropped in 1901 <sup>4</sup> . . .	7	8	-
188	THREE SHEARLING EWES . . .	10	5	-

**DARTMOOR.**

189 & 190 Same as for Kentish or Romney Marsh.

**EXMOOR.**

191 & 192 Same as for Kentish or Romney Marsh.

**CHEVIOT.**

193	RAM, SHEARLING and upward <sup>5</sup> . . .	10	5	-
194	THREE SHEARLING EWES . . .	10	5	-

**BLACK-FACED MOUNTAIN.**

195 & 196 Same as for Cheviot.

**HERDWICK.**

197	RAM, Two Shear and upward <sup>5</sup> . . .	10	5	-
198	THREE SHEARLING EWES . . .	10	5	-

**WELSH MOUNTAIN.**

199	THREE SHEAR RAM <sup>5</sup> . . .	10	5	-
200	TWO SHEAR RAM . . .	10	5	-
201	THREE SHEARLING EWES . . .	10	5	-

**RYELAND.**

202	SHEARLING RAM <sup>5</sup> . . .	10	5	-
203	THREE SHEARLING EWES <sup>5</sup> . . .	10	5	-

**RADNOR.**

204	THREE SHEARLING EWES <sup>5</sup> . . .	10	5	-
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## PIGS (£396).

Classes	Prizes		
	1st	2nd	3rd
	£	£	£
205-208 Large White . . .	.	.	.
209-212 Middle White . . .	.	.	.
213-216 Small White . . .	.	.	.
217-220 Berkshire . . .	.	.	.
221-224 Tamworth . . .	.	.	.

For Prizes  
see below

In each of the above Breeds the following prizes will be given:

BOAR, farrowed in 1899 or 1900 . . .	10	5	3
THREE BOAR PIGS, farrowed in 1901 . . .	10	5	3
BREEDING Sow, farrowed in 1897, 1898, 1899, or 1900 . . .	10	5	3
THREE Sow PIGS, farrowed in 1901 . . .	10	5	3

## LARGE BLACK.

225 BOAR, farrowed in 1899 or 1900 . . .	10	5	3
226 BREEDING Sow, farrowed in 1897, '98, '99, or 1900 . . .	10	5	3

## POULTRY (£252).

Prizes are offered for the best COCK, HEN, COCKEREL, and PULLET of the following Breeds:—

Classes	1st	2nd	3rd
	£	£	£
227-230 Game, Old English . . .	80	15	10
231-234 Game, Indian . . .	80	15	10
235-238 Dorking, Coloured . . .	80	15	10
239-242 Dorking, Silver Grey . . .	80	15	10
243 & 244 Dorking, White or Cuckoo . . .	80	15	10
245-250 Brahma and Cochins . . .	80	15	10
251-254 Langshan . . .	80	15	10
255-258 Plymouth Rock . . .	80	15	10
259-262 Wyandotte, Silver Laced . . .	80	15	10
263-266 Wyandotte, Gold Laced . . .	80	15	10
267 & 268 Wyandotte, any other variety . . .	80	15	10
269-272 Orpington, Buff . . .	80	15	10
273-276 Orpington, any other variety . . .	80	15	10
277-280 French . . .	80	15	10
281-284 Minorca . . .	80	15	10
285-290 Leghorn . . .	80	15	10
291 & 292 Andalusian . . .	80	15	10
293 & 294 Hamburg . . .	80	15	10
295-298 Any other breed (except Bantams) . . .	80	15	10
299 Aylesbury Drake . . .	80	15	10
300 Aylesbury Duck . . .	80	15	10
301 Aylesbury Young Drake . . .	80	15	10
302 Aylesbury Duckling . . .	80	15	10

Class	Prizes		
	1st	2nd	3rd
	£	£	£
303 Rouen Drake . . .	80	15	10
304 Rouen Duck . . .	80	15	10
305 Pekin Drake . . .	80	15	10
306 Pekin Duck . . .	80	15	10
307 Cayuga Drake . . .	80	15	10
308 Cayuga Duck . . .	80	15	10
309 Any Breed (except Aylesbury) Young Drake . . .	80	15	10
310 Ditto, Duckling . . .	80	15	10
311 Gander, Embden . . .	40	20	10
312 Goose, Embden . . .	40	20	10
313 Gander, Toulouse . . .	40	20	10
314 Goose, Toulouse . . .	40	20	10
315 Turkey Cock . . .	40	20	10
316 Turkey Hen . . .	40	20	10

## PRODUCE (£247 10s.).

## BUTTER.

317 Keg or other Package of BUTTER not less than 14 lb. and under 40 lb. in weight (entries close April 15, 1901). 1st 5L, 2nd 3L	
318 Box of Twelve 2 lb. Rolls of BUTTER, not more than 1 per cent. salt. 1st 5L, 2nd 3L, 3rd 1L	
319 2 lb. FRESH BUTTER, slightly salted, made up in pounds	Four of 3L each. Four of 2L each. Four of 1L each.
320 2 lb. FRESH BUTTER, slightly salted, made up in pounds, from milk drawn from Cows other than Channel Islands, or Cows crossed with Channel Islands breeds.	Four of 3L each. Four of 2L each. Four of 1L each.

## CHEESE.

	1st	2nd	3rd	4th
	£	£	£	£
321 THREE CHEDDAR, of not less than 50 lb. each, made in 1901 . . .	8	5	3	1
322 THREE CHESHIRE, of not less than 40 lb. each, made in 1901 . . .	8	5	3	1
323 THREE STILTON, made in 1901 . . .	5	3	2	-
324 THREE WENSLEYDALE (Stilton shape), made in 1901 . . .	6	3	2	-
325 THREE DOUBLE GLOUCESTER, made in 1901 . . .	5	3	2	-
326 THREE WILTSHIRE (Loaf or Flat), not over 16 lb. each, made in 1901 . . .	5	3	2	-

Class	CHEESE (contd.).	Prizes		
		1st	2nd	3rd
		£	£	£
827	THREE CAERPHILLY, not less than 10 lb. each, above 8 in. and not over 4 in. thick, made in 1901 <sup>1</sup>	5	8	2
828	THREE CAERPHILLY, not less than 8 lb. each, and not over 8 in. thick <sup>1</sup>	5	8	2
829	THREE CHEESES, any other British, made in 1901 (Cream Cheese excepted)	5	8	2

### CIDER AND PERRY.

Class		Prizes		
		1st	2nd	3rd
		£	£	£
830	Cask of CIDER, made 1900	5	8	2
831	ONE DOZ. CIDER, made 1900	5	8	2
832	ONE DOZ. CIDER, made before 1900	5	8	2
833	ONE DOZ. PERRY	5	8	2

### HIVES, HONEY, AND BEE APPLIANCES.

(Offered by British Bee-keepers' Association.)

Class		Prizes		
		1st	2nd	3rd
		£	£	£
834	Collection of HIVES	80	40	20
835	OUTFIT FOR BEGINNER	20	15	10
836	OBSERVATORY HIVE (not more than 8 frames)	20	15	10
837	FRAME HIVE	20	15	10
838	Do. for Cottagers' use	20	15	10
839	HONEY EXTRACTOR	15	10	-
840	USEFUL APPLIANCES	10	-	-
841	12 Sections COMB HONEY (1901), about 12 lb.	15	10	5

Class	HIVES, &c. (contd.)	Prizes		
		1st	2nd	3rd
		£	£	£
842	12 Sections COMB HONEY (1900 or previous years), about 12 lb.	10	7/6	5
843	12 Sections COMB HEATHER HONEY of any year, about 12 lb.	10	7/6	5
844	8 Shallow Frames COMB HONEY, 1901	10	7/6	5
845	RUN OR EXTRACTED LIGHT COLOURED HONEY (1901), about 12 lb.	15	10	5
846	RUN OR EXTRACTED MEDIUM COLOURED HONEY (1901), about 12 lb.	15	10	5
847	RUN OR EXTRACTED DARK COLOURED HONEY (1901), about 12 lb.	15	10	5
848	RUN OR EXTRACTED HONEY (1900 or previous years)	10	7/6	5
849	RUN OR EXTRACTED HEATHER HONEY (1900), about 12 lb.	10	7/6	5
850	GRANULATED HONEY (1900 or previous), about 12 lb.	10	7/6	5
851	DISPLAY OF HONEY	30	20	10
852	8 lb. of WAX	10	7/6	5
853	3lb. of WAX, in marketable form, for retail trade	10	7/6	5
854	HONEY VINEGAR $\frac{1}{2}$ gall.	7/6	5	-
855	MEAD $\frac{1}{2}$ gallon	7/6	5	-
856	OTHER PRACTICAL EXHIBITS	10	-	-
857	OTHER SCIENTIFIC EXHIBITS	10	-	-

<sup>1</sup> Offered by the Cardiff Local Committee.

### IMPLEMENTS (£135).

Class		Prizes	
		1st	2nd
		£	£
I.—	PORTABLE OIL ENGINES, POWER NOT TO EXCEED 15 B.H.P.	40	20
II.—	AGRICULTURAL LOCOMOTIVE OIL ENGINES, POWER NOT TO EXCEED 20 B.H.P.	40	20
III.—	SMALL ICE-MAKING PLANT, SUITABLE FOR A DAIRY, OUTPUT NOT TO EXCEED 4 CWT. IN TEN HOURS	15	-

### HORSE-SHOEING COMPETITIONS (£32).

(Open to the United Kingdom.)

CLASS I. HUNTERS (Thursday, June 27).

CLASS II. CART HORSES (Friday, June 28).

PRIZES amounting to 16*l.* are offered in each class.

### TIMBERING AND ROPE SPLICING COMPETITIONS.

(Prizes offered by Cardiff Local Committee.)

Class		Prizes		
		1st	2nd	3rd
		£	£	£
CLASS I.	TIMBERING, COLLIERIES ONLY	4	2	1
CLASS II.	TIMBERING, TIMBERMEN AND COLLIERIES	4	2	1
CLASS III.	ROPE SPLICING	4	2	1

Copies of the detailed Price Sheet and Regulations (both for Stock and Implements) may be obtained on application to the Secretary of the Society at 13 Hanover Square, London, W.

# NATIONAL AGRICULTURAL EXAMINATION BOARD.

*Appointed by the Royal Agricultural Society of England and the  
Highland and Agricultural Society of Scotland.*

## I. REGULATIONS AND SYLLABUS OF THE EXAMINATION FOR THE NATIONAL DIPLOMA IN THE SCIENCE AND PRACTICE OF DAIRYING.

*(As revised October 11, 1900.)*

### REGULATIONS.

1. The Societies may hold annually in England and in Scotland, under the management of the National Agricultural Examination Board appointed by them, one or more Examinations for the National Diploma in the Science and Practice of Dairying; the Diploma to be distinguished shortly by the letters "N. D. D."

2. The Examinations will be held on dates and at places from time to time appointed and duly announced.

3. A deposit of £1 will be required from each candidate, which deposit will be returned only to those who at the first attempt succeed in obtaining the Diploma. The Board may, at their discretion, allow an unsuccessful candidate to sit for one subsequent examination without payment of a further deposit.

4. Forms of Entry for the Examination in England may be obtained from the Secretary of the Royal Agricultural Society of England, 13 Hanover Square, London, W., and must be returned to him duly filled up, with the deposit of £1, on or before August 31.

5. Forms of Entry for the Examination in Scotland may be obtained from the Secretary of the Highland and Agricultural Society of Scotland, 3 George IV. Bridge, Edinburgh, and must be returned to him duly filled up, with the deposit of £1, on or before August 31.

6. A candidate may enter for the Examination either in England or Scotland, but not in both, and a candidate who has once taken part in an Examination in England cannot enter for an Examination in Scotland, or *vice versa*.

7. A candidate will be required to satisfy the Examiners by means of written papers, practical work, and *vis à voce*, that he or she has

- (1) A general knowledge of the management of a Dairy farm, including the rearing and feeding of Dairy Stock, the candidate being required to satisfy the Examiners that he or she has had a thorough training and practical experience in all the details of Dairy work as pursued on a farm.
- (2) A thorough acquaintance, both practical and scientific, with everything connected with the management of a Dairy, and the manufacture of Butter and Cheese.
- (3) Practical skill in Dairying, to be tested by the making of Butter and Cheese.
- (4) Capacity for imparting instruction to others.

8 The Board reserve the right to postpone, to abandon, or in any way or at any time to modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.

By Order,  
ERNEST CLARKE,  
*Secretary, Royal Agricultural Society of England,*  
13 Hanover Square, London, W.  
JAMES MACDONALD,  
*Secretary, Highland and Agricultural Society of Scotland,*  
3 George IV. Bridge, Edinburgh.

October 11, 1900.

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#### DATES OF EXAMINATIONS IN 1901.

**England.**—Monday, September 23, to Thursday, September 26, at the Reading College and British Dairy Institute, Reading; last date for receiving applications, August 31.

**Scotland.**—Monday, September 30, to Thursday, October 3, at the Kilmarnock Dairy School, Kilmarnock; last date for receiving applications, August 31.

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#### SYLLABUS OF SUBJECTS OF EXAMINATION.

##### I. GENERAL MANAGEMENT OF A DAIRY FARM.

1. *General Management of Pastures and Crops on a Dairy Farm.*
2. *Buildings.*—Situation, Surroundings, Construction, Ventilation and Drainage of Farm Buildings. Suitability of building materials. Water supply. Construction and arrangement of Dairies: (a) for General Purposes; (b) for Special Purposes.
3. *Foods and Feeding.*—Summer and Winter Feeding of Dairy Cattle. Root Crops. Green fodder. Ensilage. Different kinds of food and their composition. Their effect upon Milk, Butter and Cheese. Special Foods used in Dairy Feeding. Preparation of food for Dairy Stock. Rearing and feeding of young Stock. Feeding and Management of Pigs and Poultry.
4. *Dairy Cattle in Health and Disease.*—Characteristics of different Breeds and choice of Dairy Cattle. General functions of the organs of the animal body. Breeding. Parturition. Organs which secrete milk. Process of milk secretion. Changes which food undergoes during digestion. Diseases of Dairy Cattle and their remedies.

##### II. MANAGEMENT OF A DAIRY.

1. *Milk and Cream.*—Process of Milking. Dairy Utensils and Appliances, hand and power. Cooling of Milk. Separation and ripening of Cream. Different systems of Cream-raising. Utilisation of Skim-milk. Keeping of Milk. Importance of Cleanliness. Diseases spread by Milk. Conveyance and sale of Milk. Milk records. Keeping of Dairy and Farm accounts. Creameries. Butter and Cheese Factories. Different systems of Dairying and their comparative returns.
2. *Butter.*—Churns and other Butter-making appliances, hand and power. Souring of Cream. Churning. Washing and Working of Butter. Butter-milk. Packing and transmission of Butter. Salting and keeping of Butter. Colouring. Characteristics of good Butter.
3. *Cheese.*—Principles of its manufacture. Making of different kinds of Cheese (from cream, whole-milk, and skim-milk). Acidity of Milk. Use of Rennet and its substitutes. Whey. Appliances for Cheese-making. Ripening and storage of Cheese. Packing and sale of Cheese. Making of Cream and other soft Cheeses.

## III. CHEMISTRY AND BACTERIOLOGY.

General principles of Chemistry. Specific gravity: Temperature: Acidity and alkalinity—methods and instruments for determining these. The nature and general properties of substances met with in Dairy practice.

Nature, composition, properties and chemical constituents of Milk. Microscopical appearances. The changes which take place in Milk, and how produced. Circumstances affecting the quality and quantity of Milk. Influence of temperature. Chemical changes involved in keeping and souring of Milk and in the formation of Butter and Cheese. Taints, Fermentation, and Putrefaction. The Use of Preservatives. Milk testing and analysis. Detection of adulteration in Milk, Cream, Butter and Cheese.

Nature and functions of Bacteria. The commoner forms of Bacteria taking part in the operations of the Dairy.

## IV. PRACTICAL SKILL IN DAIRY WORK.

Candidates must be prepared—(1) to produce at or before the Examination a satisfactory certificate of proficiency in the milking of cows, signed by a practical Dairy Farmer; (2) to churn and make into Butter a measured quantity of Cream; and (3) to make one cheese of each of the following varieties:—(i) hard-pressed, of not less than 30 lb., (ii) veined or blue-moulded, of not less than 10 lb., and (iii) also to make one or other of the following soft Cheeses: Camembert, Coulommier, or Pont l'Évêque.

## V. CAPACITY FOR IMPARTING INSTRUCTION TO OTHERS.

*Candidates must also show practically that they are familiar with the management of a Dairy, and are capable of imparting instruction to others.*

## II. PAPERS SET AT THE EXAMINATION HELD AT READING, SEPTEMBER 1900.

## EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING, SEPTEMBER 24-27, 1900.

## QUESTIONS IN GENERAL DAIRYING.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

(Three hours allowed.)

Nos. 1, 2, 3, and 8, and at least other 6 questions to be attempted.

\*1. In walking over a farm that you propose to take as a dairy farm, what indications would assist you in forming an idea of its value for this purpose?

\*2. On a farm of 100 acres there are 20 shorthorn cows, the milk of which is retailed in a town. What food would you grow on the farm for the herd, and how much pasture would you set aside for their use? State the character of the farm you have in view, and the district in which it is situated.

\*3. Give the principal characteristics of three of the leading breeds of dairy cattle, and state the purposes for which each is specially suited.

\*4. Make an estimate of the cost of keeping a herd of 40 cows for one year, and the return from either Cheddar or Cheshire cheese and whey, all the milk being made into cheese. State the district and position of the farm you have in view.

5. Describe a good and thorough system of preparing and sweetening wooden milk-vessels which are mouldy and out of condition, so as to make them suitable for use in a butter-making dairy.

6. Describe the process of milking a cow. What are common errors in milking?

7. Describe the structure of the mammary gland of a cow and explain the process of milk secretion.

\*8. Describe a good system of ripening cream for butter-making. Compare the advantages and disadvantages of making butter (a) from ripened whole milk, (b) from ripened cream, (c) from sweet cream.

9. Describe the cause and symptoms of cow-pox; also the common method of spreading, and the treatment of this disease.

10. State fully what you know of milk fever (parturient apoplexy) in milch cows, and the steps you would take to prevent and combat this disease.

11. Describe fully an economical system of feeding calves from birth till three months old where an abundance of separated milk is available.

12. Describe the management and feeding of any breed of pigs from the time they are weaned till they are fit to be killed.

## QUESTIONS IN CHEMISTRY AND BACTERIOLOGY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

(Seven questions only to be answered, among which must be the five marked \*—i.e. 1, 4, 7, 8, and 9.)

(Three hours allowed.)

\*1. Of what importance are the *mineral* constituents of milk, considered as a food? How may they serve as a guide to the genuineness of milk?

2. What is the particular influence which the presence of lime salts in milk exercises in the coagulation of milk?

3. Describe the principal mechanical methods of testing the quality of milk. How far may they be relied upon as compared with methods of chemical analysis in the stricter sense?

\*4. Distinguish between the "sterilisation" of milk, as ordinarily carried out, and "pasteurisation" properly so called.

5. Describe the chemical changes which take place in

- (a) the keeping of milk;
- (b) the keeping of butter.

6. What "chemicals" may be legitimately used in the dairy, and which not? Name the particular uses of each material.

\*7. Describe any method for testing the acidity of curd. In what way may the knowledge gained by such a test be usefully employed?

\*8. Discuss how far the successful manufacture of a particular kind of cheese is dependent upon locality and external agencies, and how far upon manipulation and attention to details and rules.

\*9. What is tuberculous milk? Under what circumstances may such be produced? What is the present state of knowledge as regards the means by which the danger arising from the use of such milk may be guarded against?

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THE  
JOURNAL  
OF THE  
ROYAL AGRICULTURAL SOCIETY  
OF ENGLAND.

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*Third Series.*

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VOLUME THE ELEVENTH.

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PRACTICE WITH SCIENCE.

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LONDON:  
JOHN MURRAY, ALBEMARLE STREET.  
1900.

**EXTRACT FROM THE SOCIETY'S BYE-LAWS**

*(Dating from the Foundation of the Society):—*

**"The Society will not be responsible for the accuracy of the statements or conclusions contained in the several papers in the Journal, the authors themselves being solely responsible."**

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THIRD SERIES.

(SEPTEMBER 29, 1900.)

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